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# **Human-Centred Healthcare Chatbot Design: Supporting Chinese Overseas Students to Utilise UK Health Services**

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## Abstract

Over the years, Chinese students have consistently represented the largest group of overseas students in the UK. Given the inherent challenges of studying in a foreign country, maintaining good health and overall well-being becomes an essential factor for academic success. However, managing health and well-being in a foreign country can be challenging. When Chinese overseas students are ill, they face a number of obstacles, such as language barriers, limited understanding of the healthcare system, and cultural differences in healthcare practices. All of these issues impede students' use of healthcare services in the UK, making them reluctant to seek professional support and thus affecting their health and well-being. However, limited effort has been made to investigate methods for supporting Chinese overseas students in using UK healthcare services.

This thesis aims to design a chatbot prototype to support Chinese overseas students in utilising healthcare services in the UK. To do this, I employed a Human-Centred Design approach to first understand Chinese overseas students' health and well-being management behaviour, then investigate specific pain points regarding healthcare service utilisation, before finally designing the chatbot prototype based on the needs. The main contributions of this thesis are (a) Development of a grounded theory of Chinese overseas students' behaviours of accessing healthcare services, (b) An analysis of the pain points of Chinese overseas students' experiences with UK healthcare services, (c) Implementation of a chatbot prototype that helps newcomers to familiarise themselves with UK healthcare services, (d) Evaluation of the effectiveness of the designed chatbot prototype, illustrating the potential of using chatbots and other dialogue-driven solutions to support Chinese overseas students in accessing healthcare services.

I began by investigating the context of Chinese overseas students in managing health and well-being in the UK. First, I carried out an autoethnographic process to reflect on two of my own experiences with UK healthcare services. The resulting themes were used as starter topics in a grounded theory investigation with other Chinese overseas students in the UK. The interviews were conducted iteratively, and key categories emerged through constant comparison of interview data. Findings from this were used to construct a theory that explains students' reasoning on healthcare service utilisation behaviours. The constructed theory is in line with the Theory of Planned Behaviour, illustrating that aside from individual and context-specific factors, there are three key determinants which affect Chinese overseas students' intention to use healthcare services in the UK: the perceived difficulties, the attitudes towards health services, and the influences from social dynamics.

I then moved towards ideating chatbot-based solutions. To identify the pain points and needs (design requirements) of Chinese overseas students around using healthcare services, I conducted 1-to-1 co-design workshops to map their journeys and identify the pain points, as well as brainstorm a range of possibilities for chatbots to support. Qualitative analysis results suggested that pain points are related to participants' unfamiliarity with UK healthcare services, insufficient language and communication skills, and inadequate support from the NHS. Participants discussed five ways a chatbot could help them: supplying general information on healthcare services, supplying specific information on medical conditions, assisting with specific linguistic issues, and providing emotional reassurance.

The chatbot design was guided by user personas, which were developed from workshop findings. I decided to build a chatbot prototype that helps newcomers familiarise themselves with UK services and prepare for doctor consultations. I developed a rule-based chatbot that covers four use case scenarios: providing an overview of UK healthcare services, assisting with self-management and taking medications, providing guidance on handling urgent conditions and emergencies, and providing information on ways to cope with minor and chronic conditions.

To evaluate the effectiveness of the design, I conducted a Wizard of Oz experiment with a mixed-method design. Quantitative questionnaire data and qualitative interview data were collected to measure participants' experiences and their perceived usefulness of the chatbot prototype. Results suggested the chatbot design was effective in reducing perceived difficulties and boosting confidence to use healthcare services in the UK.

This work is one of the first explorations of using dialogue systems in supporting Chinese overseas students to utilise healthcare services. The chatbot prototype, created using a human-centred design approach, demonstrated the potential to help Chinese overseas students reduce their reluctance to utilise healthcare services and increase their confidence to confront challenges. Based on the findings, I argue that designing dialogue system solutions would be beneficial to support Chinese overseas students to help them prepare for accessing healthcare services, providing a good complement to traditional organisational policies.

The chatbot prototype enlightened future directions for designing and researching digital technologies to facilitate individual access to healthcare services. I conclude this thesis by suggesting potential research directions in supporting Chinese overseas students, as well as international students in general, to better utilise healthcare services in foreign countries.



### **Lay summary**

Living in foreign countries can be stressful, particularly in managing health and well-being. Chinese overseas students continuously constitute the largest cohort of international students in the UK; however, they face many challenges in using healthcare services, such as realising the need to access care, communicating with doctors, and understanding treatment processes. This research looked into Chinese overseas students on their behaviours in using UK healthcare services. Based on their pain points, the research project designed and evaluated an educational chatbot prototype that addresses the reluctance issues among the Chinese student population to access healthcare services in the UK. The results showed that the chatbot design boosted Chinese students' confidence and made them feel more capable of utilising healthcare services.

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back, there were a lot of things that I could have done better, but now I am standing at the top of this mountain, equipped with the knowledge, intelligence and experience to climb another mountain.

09/12/2024 – sitting in the office, anticipating attending this year's DI Christmas party this evening, nervously yet excitedly envisioning my next journey.

## **Declaration**

I declare that this thesis was composed by myself, that the work contained herein is my own except where explicitly stated otherwise in the text, and that this work has not been submitted for any other degree or professional qualification except as specified.

*(Liquan Chai)*

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## Chapter 1: Introduction

### 1.1 Background and Motivation

The UK is a popular destination for people around the world to pursue degrees. Among this population, Chinese students have become the largest cohort of international students in UK higher institutes since 2012, consisting of nearly a quarter of the total, and the numbers are increasing steadily each year (Universities UK, 2021). Over the past recent years, the number of Chinese overseas students studying in UK universities has exceeded 100,000, more than any other international student population in the UK (Higher Education Statistics Agency, 2023).

However, Chinese overseas students are vulnerable. They face many challenges when studying in foreign countries. For example, they can easily run into acculturation problems such as loneliness, homesickness, value differences, culture shock and lack of support (Wei et al., 2007a; Ye, 2006; Spencer-Oatey & Xiong, 2006; Fan et al., 2014; Yan & Berliner, 2011). They may also encounter academic difficulties (I. K.-H. Wang, 2018), communication burdens (Wu & Chen, 2006; A. W. Chen et al., 2009; Szabo et al., 2016; Chai, 2018), and experience excessive stress and anxiety (J. A. Chen et al., 2015; Magnusdottir & Thornicroft, 2022; Dobosz & Hetmańczyk, 2023).

Keeping healthy, both physically and mentally, is one of the crucial aspects for Chinese overseas students to complete their studies (Jung et al., 2007; Yan & Berliner, 2011; Z. Li, 2016). However, research has suggested that international students often experience a decline in their health and well-being status while studying abroad (Msengi et al., 2011). This situation is exacerbated as studies have found that Chinese overseas students are less likely to utilise healthcare services in host countries compared to other student groups (Larte et al., 2009; Ellis-Bosold, 2013; Sun et al., 2018). They are reluctant to use healthcare services even when they recognise a need for medical attention (Thomson et al., 2006; Lu et al., 2014); they postpone check-ups due to heavy school work (Larte et al., 2009); they conceal their true thoughts when talking to doctors (Tung & Li, 2015); they rely on Complementary and Alternative Medicine (CAM) such as Traditional Chinese Medicine (TCM) to relieve discomforts which are not widely available in foreign countries (Bishop et al., 2009); they also likely to misuse healthcare services such as under-using the primary care and over-using the Accident and Emergency services (A&E), resulting troubles and delays in treatments (Ellis-Bosold, 2013; Porter, 2021).

Researchers have proposed various recommendations to address this issue. For example, providing cultural awareness training to counsellors and clinicians (Bertram et al., 2014; Porter, 2021), assisting Chinese overseas students through dedicated contacts in academic and local communities (Ching et al., 2017; Heng, 2017),



increasing the number of social contacts (Bertram et al., 2014; Cao et al., 2018), making health and well-being services more accessible (Lu et al., 2014), raising Chinese overseas students' awareness of services (H. Chen et al., 2020; Mesidor & Sly, 2016; Sun et al., 2018; Yan, 2017). However, despite proposing suggestions, relatively little information is available on how these measures are implemented and how these measures work.

With the evolution of technology shaping the way people live, numerous technological solutions have been employed to promote health and well-being. Among these innovations, dialogue systems such as conversational agents (CA) or chatbots are used extensively to assist individuals in maintaining their health and overall well-being. Dialogue systems communicate with users in speech, text or both (Jurafsky & Martin, 2018). They are accessible and interactive (T. Bickmore & Giorgino, 2006). Users can interact with those systems using natural language via SMS, web pages or smartphones whenever they want. In healthcare, Dialogue systems can effectively offer assistance to individuals. They can adapt to users' responses and address their concerns by delivering tailored information and needs. Young adults, in particular, are increasingly likely to embrace dialogue systems when managing health and well-being issues (Nadarzynski et al., 2019).

Commercially, dialogue system-based applications have been used to track and offer mental health guidance, e.g., Woebot app (*Woebot Health*, 2023) and assist individuals in making sense of symptoms and answering health-related concerns, e.g., Ada (*Health. Powered by Ada.*, 2023). In addition, NHS England has recently tested dialogue systems to triage and book appointments, to streamline referral management and reduce waiting times (*Using Chatbot Technology to Improve Referral Management*, 2020; *Using an AI Chatbot to Streamline Mental Health Referrals*, 2022; *Babylon Health UK*, 2023). In academia, researchers have also employed dialogue-based technologies to address problems in healthcare. For example, keep track of chronic conditions (Schachner et al., 2020), e.g., heart failure (Galescu et al., 2009), asthma (Rhee et al., 2014), insomnia (Philip et al., 2014), and Post-traumatic stress disorder (PTSD) (R. Xu et al., 2012). Dialogue systems are also used to provide health information to address patients' concerns, for example, as symptom-checkers that help patients to figure out potential diseases that they are experiencing, help them to decide what to do, and inform patients about treatments (W. Wong et al., 2012; Ghosh et al., 2018; Bibault et al., 2019; Höhn & Bongard-Blanchy, 2021). In addition to tracking conditions and addressing concerns, researchers also studied ways that dialogue systems can be used to promote and maintain individual' health behaviour, such as goal setting and boosting inner motivations in the context of exercise and alcohol consumption (Crutzen et al., 2011; Silva et al., 2018; T. W. Bickmore & Picard, 2005; Rapp et al., 2019).

As a result, we believe dialogue systems can complement traditional policy recommendations to support Chinese overseas students in managing health and well-being in foreign countries. In particular, we imagine dialogue systems can be used to assist Chinese overseas students to facilitate their use of healthcare services in the UK. Although research has provided various recommendations to healthcare providers and policymakers, few studies have investigated the potential of using digital technologies in supporting Chinese overseas students' utilisation of healthcare services. Thus, given the prevalence and potential advantages of using dialogue-based technologies to address health-related problems, this thesis covers a series of studies to look at Chinese overseas students' health and well-being experiences and investigate dialogue system solutions to support Chinese overseas students' use of healthcare services in the UK.

## 1.2 Research Aim and Questions

My PhD project aims to design a chatbot prototype for Chinese overseas students to support them in using healthcare services in the UK.

To that end, I want to understand Chinese overseas students' use of healthcare services in the UK. I aim to investigate how Chinese overseas students decide to use UK healthcare services, identify pain points in their experiences of using healthcare services in the UK, and determine which of these pain points can be supported through the use of a chatbot. I aim to implement an interactive chatbot prototype and evaluate its effectiveness in supporting Chinese overseas students with their use of healthcare services.

In the following, I will use the term **Chinese overseas students** to denote students who come from Mainland China and are studying at UK Higher Education institutions for undergraduate or postgraduate degrees. I will use **Chinese international students** to denote Chinese students who are studying at any foreign Higher Education institution. The **healthcare services** studied are any services related to healthcare that Chinese overseas students can potentially access in the UK, including services provided by the National Health Service (NHS) as well as those by the private sector. Any services related to healthcare that Chinese overseas students can potentially access in the UK, including services provided by the National Health Service (NHS) as well as those by the private sector. The **Healthcare services** in this thesis commonly include primary care services such as General practitioners (GP), pharmacies, opticians, and dentists; secondary care services such as domain specialists; urgent care or A&E services such as 111, 999, and urgent care units; complementary and alternative medicine practitioners such as chiropractors; and mental health and well-being services such as

psychological counselling services. In addition, I will use the term **Using Healthcare Services** or **Healthcare Services Utilisation** to describe how individuals access healthcare services (Levesque et al., 2013).

In this project, I investigated the following research questions:

### 1.2.1 Research Question 1

[RQ1] How do Chinese overseas students make decisions about using healthcare services in the UK? (Chapter 4 and Chapter 5)

Many studies have highlighted that Chinese international students tend to underutilise healthcare services in foreign countries (H. Chen et al., 2020; Ching et al., 2017; Ellis-Bosold, 2013; J. Li et al., 2016; Lu et al., 2014; Thomson et al., 2006; D. Wang, 2017; I. K.-H. Wang, 2018). However, most of these studies investigated Chinese international students' health and well-being within their process of social integration (i.e., how Chinese students integrated into the host society), particularly on Chinese students' mental distress and their help-seeking behaviours (Magnusdottir & Thornicroft, 2022). While some studies mentioned difficulties in healthcare service utilisation (J. Li et al., 2016; D. Wang, 2017), little research has taken a holistic view to investigate how Chinese overseas students use healthcare services overall, particularly on how they make decisions to utilise healthcare services. Therefore, I would like to investigate how Chinese overseas students think and what Chinese students do when they are ill. In my previous interview study regarding language and communication (Chai, 2018), Chinese overseas students reported consistently that articulating and discussing health-related concerns with healthcare professionals was the most challenging communication context in their lives, showing that the language barrier affected their decision to use healthcare services. Thus, I would also like to see if any other types of difficulties impede their use of healthcare services in the UK.

To answer this overarching research question, I investigated the following sub-questions:

[RQ1.1] How do Chinese overseas students manage health and well-being in the UK? In particular, what do they do when they feel discomfort?

[RQ1.2] What are the attitudes that Chinese overseas students hold towards UK healthcare services?

[RQ1.3] What kind of underlying difficulties prevent Chinese overseas students from using healthcare services in the UK?

### 1.2.2 Research Question 2

[RQ2] How can a dialogue system (chatbot) be used to address problems that Chinese overseas students have in their use of healthcare services in the UK? (Chapter 5 and Chapter 6)

Despite previous studies that have looked at the specific needs of Chinese international students in utilising healthcare services (Ellis-Bosold, 2013; Lu et al., 2014; Porter, 2021), little is known about students' experiences, in their own words, about utilising healthcare services in foreign countries and how they would like to get help from a dialogue system. This motivates me to scrutinise Chinese overseas students' utilisation experiences to identify pain points, think about what can be changed, and discuss potential ways in which a chatbot can be used to help with the problem.

To answer this overarching research question, I investigated the following sub-questions:

[RQ2.1] What are the healthcare utilisation journeys that Chinese overseas students have experienced?

[RQ2.2] What are the pain points in these healthcare journeys?

[RQ2.3] How would Chinese overseas students like to use chatbots to support them in using UK healthcare services?

### 1.2.3 Research Question 3

[RQ3] How has the dialogue system (the chatbot prototype) we created impacted Chinese overseas students' willingness to use healthcare services in the UK? (Chapter 8)

Although research has illustrated the difficult circumstances of Chinese international students in managing their health and well-being in foreign countries (J. Li et al., 2016; Thomson et al., 2006; D. Wang, 2017), few attempts have considered using technological advances to improve this situation. I set up a mixed-method Wizard-of-Oz (WoZ) study to examine the effectiveness of the chatbot prototype we created to evaluate the potential of employing dialogue systems in addressing Chinese overseas students' problems in utilising healthcare services in the UK. To investigate the effectiveness of our educational chatbot prototype on newcomer students' willingness to use healthcare services in the UK, I used questionnaires to test the following hypotheses:

[H3.1]: Interacting with the chatbot prototype can raise the user's intention to use healthcare services in the UK.

[H3.2]: The chatbot prototype's conversation can reduce the user's perceived difficulties in visiting UK healthcare services.

[H3.3]: The chatbot prototype's conversation can change the user's attitude towards UK healthcare services to be more positive.

In addition, I used post-study interviews to triangulate questionnaire findings and further understand quantitative results that relate to the hypotheses.

### 1.3 Overview of the Thesis

#### 1.3.1 Overview of Research Methodology

This research aims to develop dialogue system prototypes that are tailored to Chinese overseas students, helping them to address problems in utilising healthcare services in the UK. To do this, we utilised Human-Centred Design (HCD) methodologies. The HCD approach provides us with a toolkit to understand the context of health and well-being management of Chinese overseas students, identify pain points that they have when considering using healthcare services in the UK, and develop and evaluate digital solutions to support Chinese overseas students.

This thesis can be split into 3 progressive phases (see Figure 1.1): the understanding phase, the ideation phase, and the implementation phase. We used different research methods in each phase. Specifically, we used autoethnographic writing (O'Hara, 2018) and Grounded theory (Charmaz, 2006a) to understand the context. We hosted co-design workshops to ideate the design (Bradwell & Marr, 2008), and we set up Wizard-of-Oz experiments (Dahlbäck et al., 1993) to evaluate the effectiveness of the chatbot prototype we built.

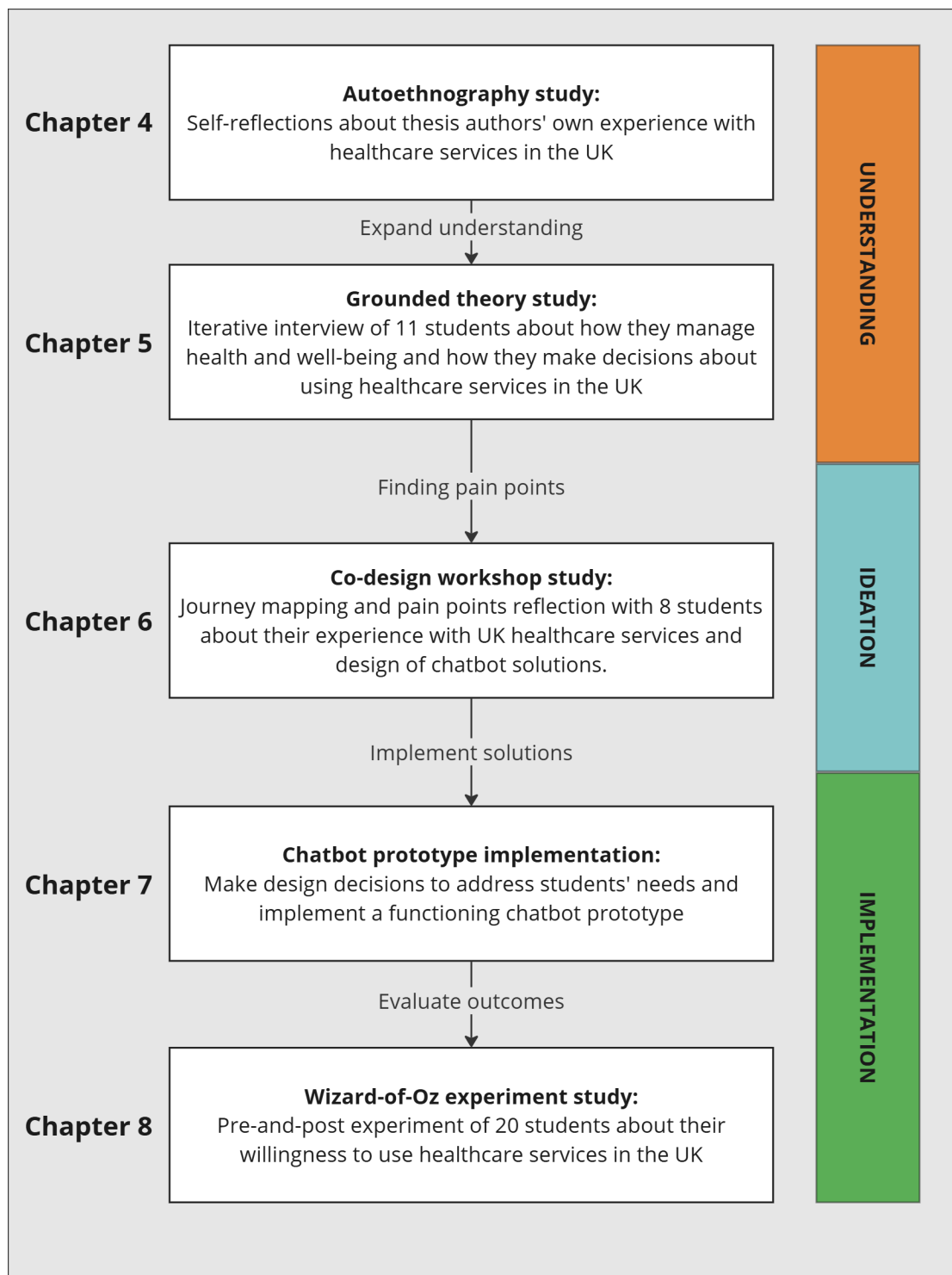


Figure 1.1 The research process of this PhD thesis. This research is structured in a linear progressive order. The first 2 studies aim to understand the contexts of Chinese overseas students' use of healthcare services, addressing RQ1. Next, the co-design workshop aims to ideate chatbot-based solutions for support, addressing RQ2. The chatbot prototype was implemented based on students' reflections on pain points and their ideations. The Wizard-of-Oz study evaluated the chatbot prototype implementation, addressing RQ3.

### 1.3.2 Overview of Chapter Contents

In Chapter 2, I introduce the core concepts in the thesis: health, well-being and healthcare service utilisation. Next, I give an overview of the situation of Chinese international students regarding their usage of healthcare services in foreign countries. This outlines some common difficulties that this group experiences. In addition, I describe four theoretical frameworks associated with healthcare utilisation and health behaviour change. These theories help to formulate the theoretical basis of the chatbot prototype design.

In Chapter 3, I describe how technologies, particularly dialogue-based systems, are used to assist health and well-being management. I also discuss the potential of using dialogue-based systems to improve the situation of Chinese overseas students. After that, I present my approach to designing a dialogue system, the Human-Centred Design (HCD), and explain individual methods that I used to understand Chinese overseas students, as well as ideating and evaluating the chatbot prototype.

In Chapter 4, I narrate two of my experiences, emergency dental care and my first visit to the GP. This was the first step to making sense of Chinese overseas students' difficulties and feelings in healthcare and well-being management. Thoughts and feelings were reflected using the thematic analysis. Communication, limited health knowledge, difficulties in information searching and difficulties in emergency handling formed a set of initial discussion topics used for the grounded theory study.

In Chapter 5, I used the grounded theory approach (Charmaz, 2006a) and iteratively interviewed 11 Chinese overseas students about their healthcare and well-being management experiences with a particular focus on how they decided to use UK healthcare services. Interview themes were constructed and adjusted through constant comparison of coding results. After theme saturation, the resulting themes were framed into a conceptual framework based on the Theory of Planned Behaviour (Ajzen, 1991). Results suggested that students' perceived difficulties, their attitudes towards UK healthcare services, and social influences, together with individual and situational-specific factors, determine students' intention to use healthcare services in the UK. This answers RQ1, "How do Chinese overseas students decide to use healthcare services in the UK".

In Chapter 6, I describe a co-design workshop with Chinese overseas students. We used journey mapping to identify problems in their process of healthcare utilisation, and we used card sorting activities to refine those problems into pain points. After that, we used storyboarding and role-playing activities to capture students' expectations for chatbot support. I carried out both content analysis and thematic analysis of workshop materials. Results suggested students' pain points are related to unfamiliarity with UK healthcare services, insufficient language and communication skills, and inadequate

support from NHS. Participants would like to use chatbots in 5 ways: a health information provider, an educational chatbot, a conversation translator, a patient portal, or a source of reassurance. This chapter answers RQ2, “How can a chatbot be used to address problems that Chinese overseas students have in their use of healthcare services in the UK”.

Chapter 7 documents the development of the chatbot prototype. In Chapter 6, I illustrated the design and implementation of the chatbot prototype. I built 3 distinct personas to categorise students’ pain points and their desired forms of chatbot support based on the results in the previous chapter. I discussed possible design directions and decided to build an educational chatbot that focuses on helping Chinese overseas students make sense of the UK healthcare services and prepare for consultations. The chatbot consists of 4 use case scenarios: the overview of UK healthcare services, self-management and taking medications, handling urgent conditions and emergencies, and handling minor and chronic conditions. By the end of this chapter, I had developed a rule-based, FSM-controlled, human-scripted chatbot that is targeted at Chinese overseas students who have just arrived in the UK.

In Chapter 8, the chatbot prototype was tested in a Wizard of Oz experiment to evaluate its effectiveness on Chinese overseas students’ willingness to use UK healthcare services. I invited 20 newcomer students to interact with the chatbot prototype, and I collected questionnaire (quantitative) results and interview (qualitative) results about participants’ experiences and their perceived usefulness of the chatbot prototype. Results indicated that the educational chatbot prototype has significantly reduced their perceived difficulty and boosted their confidence to visit healthcare services, demonstrating the potential of chatbots to assist Chinese overseas students in utilising UK healthcare services. This answers RQ3: “How has the chatbot we created impacted Chinese overseas students’ willingness to use healthcare services in the UK”.

In Chapter 9, I take a holistic point of view to reflect on all my studies in answering Research Questions 1, 2 and 3. I summarise the achievements and limitations of those research questions. In addition, I discussed how the designed chatbot prototype contributes to the field of promoting healthcare service utilisation. I also discussed future directions for improvements on the chatbot design and other possible practices to better support Chinese overseas students to utilise healthcare services.

## 1.4 Research Contributions

This PhD project aimed to design a chatbot prototype for Chinese overseas students to support them in using healthcare services in the UK. To do this, we used an HCD approach to understand the context of Chinese overseas students’ use of healthcare



services, identified pain points in their experiences of using healthcare services in the UK and designed, implemented and evaluated a chatbot prototype that helps Chinese overseas students to use healthcare services in the UK.

This thesis makes four main contributions:

1. An in-depth understanding of Chinese overseas students' healthcare management behaviour, in particular as it relates to utilising healthcare services in the UK. The understanding is conceptualised into a framework that describes the way that students make decisions to use healthcare services in the UK.
2. Summary of the detailed pain points of Chinese overseas students' experiences with using healthcare services in the UK, highlighting difficulties that students would like to be addressed by chatbots.
3. Implementation of a chatbot prototype that helps newcomer students familiarise themselves with UK healthcare services. Design considerations are drawn from Chinese overseas students' pain points and preferences.
4. Evaluation of the effectiveness of the designed chatbot prototype using a mixed-method study which illustrates the potential of using a chatbot to support Chinese overseas students in using healthcare services in the UK.

## Chapter 2: Background

### 2.1 Introduction

In this chapter, I present an overview of healthcare service utilisation as well as Chinese international students' use of healthcare services. This chapter consists of 3 sections: the basic concepts, including health, well-being, behavioural change and healthcare utilisation, the context for design, i.e., barriers to Chinese overseas students' use of healthcare services, and theories that are relevant to the artefact design, i.e., conceptual models in promoting behavioural changes.

In the first section, I will explain the notion of health and well-being, the concept of health behaviour and the process of healthcare utilisation, and then review relevant works on the behaviour of healthcare utilisation.

In the second section, I will outline the challenges that immigrants, Chinese immigrants and Chinese international students face when using healthcare services in foreign countries. These two sections aim to provide a fundamental understanding of the problem space for design, i.e., what the healthcare utilisation is and why it is challenging for Chinese overseas students to utilise healthcare services in foreign countries.

In the third section, I introduce four theoretical frameworks from public health and psychology which explain either general or specific health behaviours, including the Behavioural Model and Access to Medical Care (R. Andersen, 1968), the Social Cognitive Theory (Bandura, 1986), the Health Belief Model (Becker, 1974), and the Theory of Planned Behaviour (Ajzen, 1991). These theories help us to deepen the understanding of the behaviour of healthcare service utilisation, particularly on the mechanisms of patients' decision-making on health behaviours. These theories serve to guide design inspirations for designing artefacts to support Chinese overseas students with their use of healthcare services.

### 2.2 Health Behaviour and Healthcare Service Utilisation

#### 2.2.1 Health, Well-being and Health Behaviour

Health and well-being are two concepts that relate to the overall state of an individual's physical condition, mental well-being, and social connectedness (WHO, 1946). Health, according to the World Health Organisation (WHO), is described as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity (WHO, 1946, p.1)". Well-being, on the other hand, refers to the

state of subjective feelings of life, such as life satisfaction, positive emotions a sense of purpose (The WHOQOL Group, 1995).

Health behaviours, also known as health-directed activities, are behaviours that individuals engage in, that can impact their health and well-being status (Renner, 2001). In people's daily lives, we perform health behaviours consciously and unconsciously (Kelly & Barker, 2016), and are influenced by the behaviours of others (Short & Mollborn, 2015). Typical health behaviours include exercise, diet, smoking, sleep, sexual activities, health information-seeking behaviours, and adherence to treatments (Spring et al., 2012). Health behaviours can affect individuals' health and well-being positively or negatively. Positive health behaviours such as regular exercise or regular check-ups, promote and maintain individuals' health and well-being, whereas negative health behaviours such as smoking or excessive alcohol use, detrimentally affect individuals' health and well-being (Short & Mollborn, 2015).

Over the years, studies have looked at the prevalence of health behaviours in populations. For example, studies to estimate the smoking population in the United States (Drope et al., 2018; Trinidad et al., 2011), studies about sleeping patterns across countries (Chaput et al., 2015; X. Liu et al., 2005), and studies to track the alcohol consumptions among UK college students (J. S. Gill, 2002; Pincock, 2003). Other studies tried to understand specific health behaviours and why people engage (or do not engage) with them. For example, studies to investigate binge drinking (i.e., excessive drinking) among UK college students (Gardner et al., 2012), the use of electronic cigarettes in the adolescent population (Johnson et al., 2017), maintaining physical exercise (Ingledew et al., 2009), and adherence to treatments (Roter et al., 1998).

Apart from understanding health behaviours, research has also found ways to promote positive and minimise negative health behaviours. Common techniques for promoting and minimising negative behaviours can be grouped along interventions that: 1. Dispensing knowledge, such as websites such as NHS Inform (*NHS Scotland*, 2023) provide a wide range of health information; 2. Understanding user behaviour, through examining online healthcare information searching (Y. Zhang et al., 2012). Triggering critical reflections on unhealthy behaviours through game-playing (J. Wong et al., 2021), 3. Activity tracking on wearable devices, such as recording sleeping patterns (Ravichandran et al., 2017) and physical exercises (Consolvo et al., 2009), 4. Utilising social media to promote positive health behaviours and discourage negative health behaviours (Kamal et al., 2010).

## 2.2.2 Healthcare Service Utilisation

Healthcare service utilisation broadly refers to the action of accessing healthcare services. People utilise healthcare services for many reasons: relieving discomfort, preventing and curing illnesses, maintaining health and well-being, or obtaining information about their health status (Carrasquillo, 2013). From the patient's perspective, it can be seen as one of the “health behaviours” which affect their state of health and well-being. Healthcare Service utilisation can be measured in many ways. Common healthcare service utilisation indicators are the aggregated numbers of services used, the percentage of services used divided by a population, and the percentage of individuals who are eligible for a certain type of service (Carrasquillo, 2013).

Levesque et al. (2013) defined access to healthcare services as “the opportunity to reach and obtain appropriate healthcare services in situations of perceived need for care”. They detailed the process of access to healthcare services as a six-stage “pathway”: having healthcare needs, perceiving the needs and desire for care, seeking the healthcare service, reaching the care service, utilising the healthcare service and fulfilling the healthcare needs (Figure 2.1).

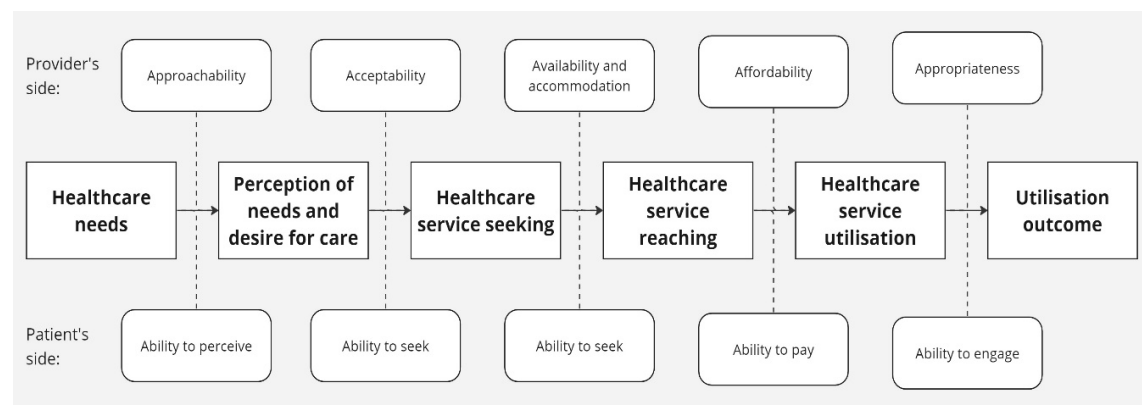


Figure 2.1 A conceptual framework of access to healthcare services (Levesque et al., 2013b). This includes 6 steps: having healthcare needs, perceiving the needs and desire for care, seeking the healthcare service, reaching the healthcare service, utilising the healthcare service, and fulfilling the healthcare needs. There are 5 dimensions of “accessibility” on the healthcare provider’s side and the patient’s side: Approachability vs. Ability to perceive; Acceptability vs. Ability to seek; Availability and accommodation vs. Ability to reach; Affordability vs. Ability to pay; Appropriateness vs. Ability to engage.

Here, “Healthcare needs” refers to the status of being ill or having discomfort. This is the stage where the patient has a healthcare need but does not take any further action. “Perception of needs and desire for care” refers to the stage where the patient starts to realise the need to use healthcare services. However, due to barriers and concerns such as trust and expectations, the patient may not start to seek professional help.

“Healthcare service seeking” refers to the initiation of healthcare service on the patient’s side. At this stage, the patient maps their healthcare needs to specific healthcare services. “Healthcare reaching” refers to the initiation of healthcare service on the healthcare provider’s side. The patient books an appointment with the healthcare service provider and visits the healthcare service if it needs to be attended to in person. “Healthcare utilisation” refers to the actual use of the healthcare service, such as GP consultation, A&E, or specialist screening. “Utilisation outcome” refers to the outcome, whether or not the patient’s needs are fulfilled by using the healthcare service.

Levesque et al. (2013b) regard “accessibility” in the context of healthcare utilisation as having two sides of meanings. One is on the healthcare service provider’s side: the ability to provide opportunities to patients. The other is on the patient’s side: the ability for the patient to use healthcare services. In their framework, they specified 5 dimensions for each side that determine the “accessibility” of healthcare utilisation, approachability vs. the ability to perceive, acceptability vs. the ability to seek; availability and accommodation vs. the ability to reach; affordability vs. the ability to pay, and appropriateness vs. the ability to engage.

Approachability relates to the fact that healthcare service providers can make people recognise the existence of available services. The ability to perceive refers to individuals’ ability to be aware of their healthcare needs and aware of the existence of corresponding healthcare services. Acceptability refers to the social and cultural norms which the healthcare service is accepted by the targeted population. The ability to seek, on the other hand, refers to individuals’ autonomy and ability to seek professional help. Availability and accommodation refer to the capability of the healthcare service can be reached promptly. The ability to reach relates to individuals’ mobility, time flexibility, and knowledge of attending the service. Affordability and ability to pay link to the level of cost of using the healthcare service and one’s financial status to pay for the service. Appropriateness denotes the quality and fitness of the treatment plan after the treatment is initiated. Complementary to appropriateness, the ability to engage refers to individuals’ level of participation and involvement in the treatment process after the treatment is initiated (usually chronic conditions). People with more engagement means they are more responsible for their conditions and take a more active role in resolving their health problems.

Patients’ utilisation of healthcare services involves multiple parties. According to Ferlie and Shortell (2001), patients’ healthcare service utilisations can be viewed from 4 perspectives: the individual patient level, the healthcare team level (e.g., clinicians, pharmacists, and other healthcare workers), the organisation level (hospital, clinic, and service providers) and the societal level (e.g., legal framework, cultural values, and socioeconomic status).

At the individual level, research has investigated barriers which prevent patients from accessing healthcare services. For example, the perception of responsibility to stay healthy (Viktorsson et al., 2022), the perception of the need to seek help (Gulliver et al., 2010), the perception of service quality (Alrubaiee & Feras, 2011; Hu et al., 2019), the level of health literacy (Mantwill & Schulz, 2017) and the financial status of individuals (Åhs et al., 2012).

At the care team level, research has investigated healthcare workers and their impact on patients' utilisation of healthcare services. For example, medical knowledge and training of healthcare workers and their influence on illness detection (Khalili et al., 2012). Studies have also looked into how healthcare workers interact with patients. For example, how healthcare workers persuade patients to obtain vaccinations (Karras et al., 2019) and techniques for healthcare professionals to interact with patients (Burns et al., 2012). Apart from techniques and training, some researchers discussed the effect of trust between patients and healthcare workers, highlighting that this relationship is also vital for healthcare services utilisation (Puett et al., 2015).

At the system level, researchers have focused on investigating the existing state of affairs in the healthcare systems and discussing improvements and adjustments. For example, the inequity of access to primary care services (McCollum et al., 2016, 2016), the affordability of services (Erlangga et al., 2019; Ma & Nolan, 2017; Murray et al., 2014) and evaluating mechanisms of how healthcare services are provided (Pande et al., 2013; Rassa et al., 2023).

At the societal level, research has investigated the relationship between sociodemographic factors and healthcare utilisation across patient populations. For example, patients' age (Roe et al., 2017; Sezgin et al., 2020), sex (Mzembe et al., 2023), ethnicity, sociocultural background (Lindert et al., 2008), and socioeconomic status (C. Q. H. Chan et al., 2018; Mulyanto et al., 2019).

Access to healthcare services is more complicated than it seems. For example, individuals have to interact with various healthcare workers (e.g., doctors, nurses, caregivers, pharmacists, etc.) to be treated properly. However, this communication can be fraught. Patients may be anxious, with low health literacy and unrealistic expectations, while doctors may be non-informative and non-collaborative (Ha & Longnecker, 2010; Sudore et al., 2009), resulting in miscommunication and distrustful relationships.

### 2.2.3 Barriers to Immigrants' Use of Healthcare Services

Like native residents, immigrants need access to healthcare services in their host country to maintain their health and well-being while living, studying, or working there. However, research has shown that, compared to the native population, immigrants are a vulnerable group at risk of having inadequate healthcare globally (Deroose et al., 2007; Dias et al., 2011; Roe et al., 2017; C. X. Zhang et al., 2022). Research indicates that immigrants are more likely to develop complex conditions compared to the larger native population (Hayanga et al., 2021). At the same time, they perceive themselves to be disadvantaged in managing their health (S. S. Nielsen & Krasnik, 2010). They are less likely to have health insurance, have a regular place of care, or with sufficient knowledge about the healthcare services available. They tend to use health services less frequently than the native population (Deroose et al., 2007; Galanis et al., 2013; Pitkin Deroose et al., 2009; K. T. Xu & Borders, 2008). Specific to the UK, although NHS services are free to all legal immigrants (*NHS Entitlements*, 2023), studies have suggested that not all of them register with the primary care service (GP) (G. Cooke et al., 2007; Hargreaves et al., 2006; Katikireddi et al., 2004; Stagg et al., 2012), despite GPs being the “gatekeepers” in utilising healthcare services. Even for those who do register, studies suggested that immigrants had lower GP consultation rates compared to the general population (C. X. Zhang et al., 2022), particularly for those who recently arrived in the UK (Saunders et al., 2021).

There is a range of barriers that are specific to immigrants which impede them from utilising healthcare services. Common ones include language and communication, socio-economic status, sociocultural influences, and healthcare service familiarisation (Deroose et al., 2007).

Language and communication is the most prominent barrier that prevents immigrants from the service utilisation. Linguistically, immigrants may not have the same level of language proficiency compared to the native population. This will cause trouble when the patient interacts with the healthcare providers. Studies showed that immigrants are less confident, less verbally communicative, less expressive and more likely to misunderstand when interacting with healthcare workers (Håkonsen et al., 2014; Schouten & Meeuwesen, 2006). This poor quality of interaction will lead to negative consequences such as increased psychological stress for the patient, communication errors and misunderstandings of potential health risks (Meuter et al., 2015). Beyond linguistics, misunderstandings in doctor-patient communication often lead to dissatisfaction and distrust on both sides (Al Shamsi et al., 2020). Studies have demonstrated that misunderstandings and misinterpretations of needs and wishes significantly impact immigrants' utilisation of healthcare services (Akhavan, 2012; Henderson & Kendall, 2011; Småland Goth & Berg, 2011).

Socio-economic backgrounds such as level of education, state of employment, and income affect immigrants' use of healthcare services (Deroose et al., 2007). Siddiq and Najand (2022) pointed out that immigrants with lower income, lower education and parental education levels tend to have poorer health and more difficulties coping with health issues. Immigrants with limited occupational opportunities tend not to have health insurance, or they are not entitled to use healthcare services (Chaves & Gerosa, 2019; Garcini et al., 2022).

Sociocultural influences are another aspect which prevents immigrants from using healthcare services. According to Akhavan (2012), cultural diversity affects people's interpretations of illnesses. Immigrants from different cultural backgrounds tend to have different expectations towards treatment. Research also showed that within individual immigrant groups, people hold specific cultural beliefs that make them reluctant to use healthcare services. For example, some religious populations regard mental health as a spiritual problem and prefer nonmedical interventions (Choudhry et al., 2016; Whitley et al., 2006). Some Asian ethnic groups regard sexual health as a cultural taboo, and they feel shame in seeking professional support (Jahangir & Meyer, 2020). Beyond individual immigrant groups, immigrants are also prone to being discriminated against in the treatment process. As anti-immigrant sentiment has grown in Europe in recent years (Czaika & Di Lillo, 2018), immigrants are experiencing unfairness in treatment (Kemppainen et al., 2018). Common discrimination in healthcare settings relates to stereotypical attitudes about race, religion, and immigration status (C. Kang et al., 2019). This is considered to be a significant barrier for immigrants to use healthcare services in the host country (Rivenbark & Ichou, 2020).

In addition, immigrants, particularly those who arrived for a short period, will not familiarise themselves with services in the host country. They do not know where to seek professional help, and they cannot use services effectively. Many studies have illustrated that immigrants were confused about ways to initiate the treatment process in the host country (Abbott & Riga, 2007; Terraza-Núñez et al., 2011; Suurmond et al., 2013; Czapka & Sagbakken, 2016). Galanis (2013) surveyed immigrants in Greece and showed that only one-fourth of the sample immigrants have a good degree of knowledge about public healthcare services. In reality, research revealed that immigrants considered using healthcare services in their home country once they encountered health issues (Osipovič, 2013). For those who use healthcare services in the host country, it is reported that they have high levels of dissatisfaction, frustration and distrust against healthcare providers (Madden et al., 2017).

The underutilisation of healthcare services is directly associated with poorer health conditions. Given those barriers, research suggested that immigrants are more likely to run into longer stays in hospital, with more serious health problems, and heightened mortality rates (Chavez, 2012). On the other hand, the underutilisation of healthcare



services by immigrants also poses a stress on the healthcare system. With the absence of routine care, studies have found that immigrants are more likely to visit urgent or emergency departments as substitutes (Cots et al., 2007; De Luca et al., 2013).

#### **2.2.4 Barriers to Chinese Immigrants' Use of Healthcare Services**

Like other immigrant groups, Chinese immigrants use healthcare services less frequently compared to the native population (A. W. Chen & Kazanjian, 2004; S. Liu et al., 2013). Chinese immigrants are often dissatisfied with the quality of care (R. Liu et al., 2007; Pinder et al., 2016). Many studies revealed that Chinese immigrants tend to use healthcare services less often compared to other immigrant groups (Pinder et al., 2016; Smaje & Le Grand, 1997; Goldstein et al., 2014; Huang & Spurgeon, 2006; Read & Smith, 2018). Sproston et al. (2001) reported that Chinese people in the UK are likely to avoid using GP consultations compared to the natives, as well as other ethnic minorities with the same health status.

The cultural background of Chinese immigrants is drastically different from Western countries such as the UK. Pinder et al. (2016) pointed out that Chinese immigrants' poor experience of healthcare services is caused by differences in health beliefs, health practices and expectations of treatments. Chinese people commonly use Traditional Chinese Medicine (TCM) concepts to perceive their state of health and well-being. According to TCM, health is determined by the concept of "Yin" and "Yang". Keeping healthy means maintaining the balance between "Yin" and "Yang". Discomfort is a result of the imbalance between "Yin" and "Yang". In TCM, symptoms can be regarded as "Leng (cold)", i.e. too much "Yin" or "Re (hot)", i.e. too much "Yang". TCM practices, such as acupuncture and Chinese herbal medicine, adjust "Yin" and "Yang" to keep their balance and facilitate the body to heal itself (Lao et al., 2012). This drastic difference in health beliefs and practices makes doctor-patient communication rather difficult (Betancourt, 2004; Jovchelovitch & Gervais, 1999; Kandula et al., 2007). While doctors in China can recognise medical complaints in TCM terms and use mixed (i.e., TCM and Western) practices to treat patients, doctors in the UK may not be able to do so. During the consultation, Chinese patients may attribute causes and expect treatments differently from their doctors. For example, it is common for Chinese people to attribute mental distress to somatic illness (Ryder et al., 2008), causing misdiagnoses, conflicts, and dissatisfactions. Kleiman et al. (2006) advocated raising doctors' cultural awareness by distinguishing diseases from illnesses. They define illnesses as the "narrative of diseases", and doctors should listen to patients' narratives during the diagnostic process to understand patients' context comprehensively.

### 2.2.5 Barriers to Chinese International Students' Use of Healthcare Services

Similar to other Chinese immigrants, Chinese international students are less likely to utilise healthcare services in host countries (Sproston et al., 2001; Ellis-Bosold, 2013; Magnúsdóttir & Thornicroft, 2022). While Chinese international students share the same cultural challenges as other Chinese immigrants, they also have specific challenges. One important challenge is acculturation, the process of adapting one's attitudes, behaviours, and social norms to fit into the new culture (Abraído-Lanza et al., 2005). Chinese international students have to adapt to the host culture in order to succeed in their studies (Gu & Maley, 2008; Pedersen et al., 2011).

Acculturation challenges Chinese students in 2 main ways. The psychological distress and the sociocultural difficulties. Psychological distress refers to the worsening of psychological well-being, while sociocultural difficulties refer to the inability to interact with the host society effectively (Ward & Kennedy, 1996). Studies have shown that Chinese international students are likely to experience excessive academic stress (D. Wang, 2017; Wei et al., 2007a), as the Chinese education system tends to be more directed by teachers and students learning knowledge passively, whereas the UK system encourages more self-learning and critical thinking (Paine, 1990; Sit, 2013). Furthermore, Chinese international students typically have high expectations for academic success. (D. Wang, 2017). These factors together lead to perfectionism, excessive stress, and even depression (Wei et al., 2007a).

Another source of distress comes from the lack of social connections. When Chinese students first come to the host countries, they have to re-establish a new social network. This process can be challenging because they have to start from scratch, and they need to make friends with different cultural backgrounds. Research has shown that social connection is inversely related to acculturative stress (Berry et al., 1987; Yeh & Inose, 2003). Some Chinese students felt disconnected from the host society therefore resulting in poor mental health (Bertram et al., 2014).

Apart from psychological distress, Chinese international students will also need to tackle sociocultural difficulties, i.e., difficulties that result from differences between the native and the host society. Specific to healthcare, healthcare systems between the UK and China are drastically different. The Chinese system is hospital-centralised, people visit general hospitals if they feel discomfort. Whereas the UK system is more decentralised. People visit primary care services first and then visit specialists in hospitals if necessary. Studies reported that Chinese international students need to contact many departments in order to receive the right treatment. This perception makes the process seem time-consuming and demanding for them. (Hesketh & Zhu, 1997; C.-H. Liu, Ingleby, & Meeuwesen, 2011; X. Z. Liu & Wang, 1991).

Health information seeking is another sociocultural difficulty. Chinese international students may find it hard to seek official, trusted health information online. Chinese international students may not be aware of the official sources of health information, such as NHS 111. Instead, studies have suggested that Chinese international students rely on Chinese search engines, e.g., Baidu, and Chinese social media, e.g. WeChat, to obtain health information (Astarita & Patience, 2020; Ling & Tran, 2015). As most information is from Chinese sources, these information pieces may not be compatible with health practices and treatment processes in the host country. At the same time, health information from these sources is embedded with personal opinions, beliefs and potentially commercial interests, making it difficult to judge their credibility (Jang & Yi, 2023; D. Zhang et al., 2021).

The lack of external support also poses a challenge for Chinese international students. As stated previously, Chinese international students have limited social connections. This leads not only to psychological distress but also lack of social capital. For example, when running into health issues, Chinese students may find it hard to find someone for help (D. Wang, 2017). This is particularly problematic in the case of managing mental well-being, as research revealed that Chinese international students tend to rely on informal help such as peer support to overcome difficult times (Ching et al., 2017; Magnusdottir & Thornicroft, 2022).

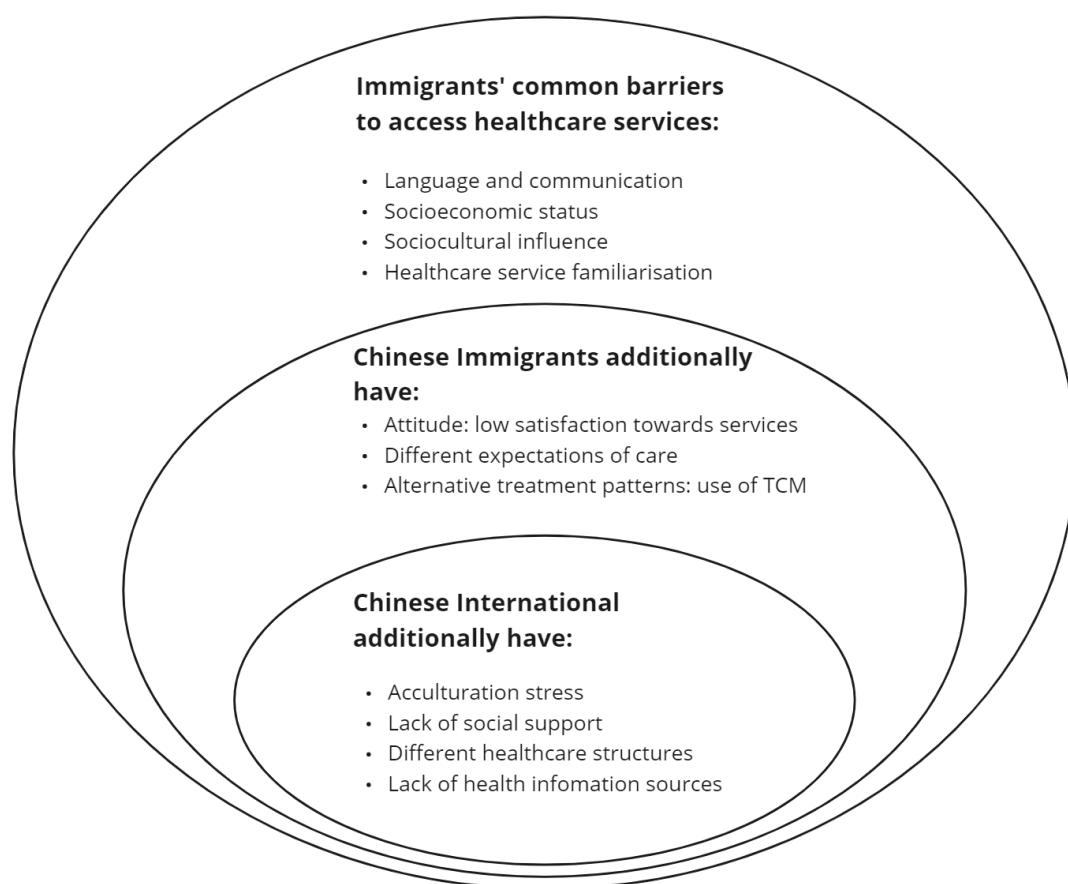


Figure 2.2 Types of challenges that general immigrants, Chinese immigrants and Chinese international students face regarding the use of healthcare services in foreign countries.

Figure 2.2 illustrates different types of challenges that Chinese overseas students face in utilising healthcare services in the UK. This includes language and communication barriers, relatively low social and economic status, and unfamiliarity with UK services that align with other immigrant groups. They also have to face the challenge of changes in health beliefs, where TCM concepts and practices that they are used to are no longer available. Due to the need to adapt to the new environment, Chinese international students are vulnerable to mental health issues, and they have to overcome a number of difficulties that arise from integrating into the new society. Without any support, Chinese overseas students will likely be reluctant or run into problems using healthcare services in the UK.

### 2.3 Theories in Healthcare Service Utilisation and Behaviour Change

From the patients' perspective, healthcare service utilisation can be regarded as a health behaviour which affects their state of health and well-being. In this section, I will describe four conceptual models from public health and psychology, explaining ways to change and maintain health behaviours. This includes the Behavioural Model and Access to Medical Care, the Social Cognitive Theory (SCT), the Health Belief Model (HBM), and the Theory of Planned Behaviour (TPB). These conceptual models serve to guide us in understanding patients' use of healthcare services, identifying key aspects that influence the decision-making of Chinese overseas students' utilisation of healthcare services in the UK.

#### 2.3.1 Behavioural Model and Access to Medical Care

The Behaviour Model and Access to Medical Care is a conceptual model first developed by Andersen (R. Andersen, 1968), and it was revised over the years (Aday & Andersen, 1974; R. M. Andersen, 1995) to explain why people seek healthcare services and how they utilise healthcare services. It is (R. M. Andersen, 1995) a widely used framework in public health to promote policies in addressing problems in healthcare service access (Akresh, 2009; Cabassa et al., 2006; Derose et al., 2011).

The Behaviour Model and Access to Medical Care categorise factors of service utilisation into 3 groups: predisposing characteristics, enabling resources, and individual needs. All factors in those 3 sets contribute to individuals' final decision of healthcare utilisation. Predisposing characteristics are personal characteristics and beliefs that they hold before the experience of illness. This category includes

demographic factors such as age, gender, and state of health. This represents biological imperatives, suggesting the likelihood of a person using healthcare services. Social structures, such as education, occupation, and an individual's social status within a community or an ethnic group, represent a person's socioeconomic ability to access healthcare services. Health beliefs, such as values and attitudes toward healthcare services, and health knowledge, such as the level of understanding about the symptoms and services available, contribute to an individual's perceptions of the need and use of healthcare services. Enabling resources are resources that make the service utilisation happen. This includes economic resources such as income and health insurance; regular sources of care such as primary care doctors; and availability of services such as travelling and waiting time. The concept of individual needs are factors that contribute to the perceived and evaluated need to use healthcare services. This includes an individual's perceived condition, such as interpretations of the symptoms, as well as evaluated needs suggested by healthcare professionals.

In addition to three groups of factors that relate to individuals, Andersen and his colleagues (1974) added the "healthcare system" category of factors into the model, to represent factors associated with healthcare providers. This includes factors such as healthcare policies, resource availability at the scale of the healthcare system, and ways that the healthcare system is organised. They also added the "outcome" after the "service utilisation" category to recognise the consequence of the use (or not use) of healthcare services and the level of the patient's satisfaction. Later on (R. M. Andersen, 1995), a new "external environment" category was added to expand the model further to explain the influence of the physical, political and economic environment of a society on the use of healthcare services. The full model is illustrated in Figure 2.3. The three individual-related categories are shown in sequential causal order, with the two mediating exogenous categories, together determining the behaviour of healthcare utilisation. The outcome of the utilisation had a feedback effect on individual-related categories, representing cases where the patient uses healthcare services more than once.

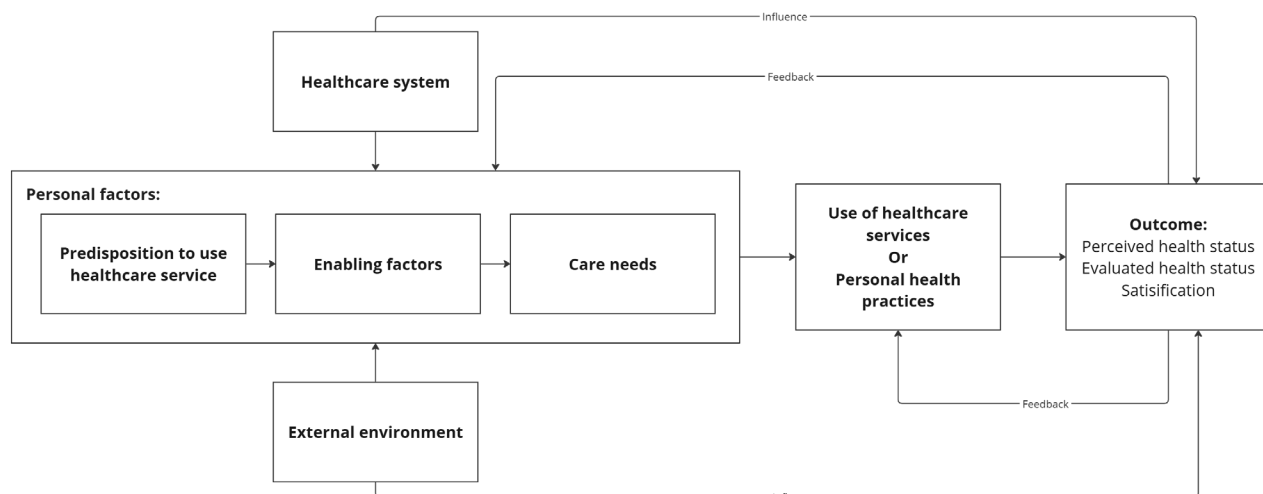


Figure 2.3 The Behaviour Model and Access to Medical Care (R. M. Andersen, 1995). Personal factors (predisposing characteristics, enabling resources, individual needs), the healthcare system, and the external environment co-determine the individual's use of healthcare services. The outcome of the utilisation affects the patient's future use of healthcare services.

The Behaviour Model and Access to Medical Care provide a holistic overview of the topic of healthcare service utilisation, considering a wide range of factors that go beyond the presence of illness. People's use of healthcare services is influenced by individuals' characteristics, healthcare providers' policies and the context of society. However, this model is challenging to apply comprehensively as factors in multiple dimensions need to be considered (Yang & Hwang, 2016). It is hard to use this model to predict the effect of any changes, because of the extensive feedback loops in this model.

### 2.3.2 Social Cognitive Theory (SCT)

In psychology, a number of theories were proposed to explain the process of how people initiate, maintain or make changes to perform behaviours. The Social Cognitive Theory (SCT) (Bandura, 1986) is a popular theory that explains human behaviours as the outcome of internal cognition and external reinforcement. This model has been applied to many fields to understand different human behaviours, including education (Zimmerman, 1989), organisation management (Wood & Bandura, 1989), as well as health behaviours (Bandura, 2004). The SCT attribute human behaviours to three key drivers: behavioural factors, cognitive factors and environmental factors. These three drivers intertwine to shape the performance of the behaviour, called the "reciprocal determinism" mechanism. An overview of the SCT model is illustrated in Figure 2.4.

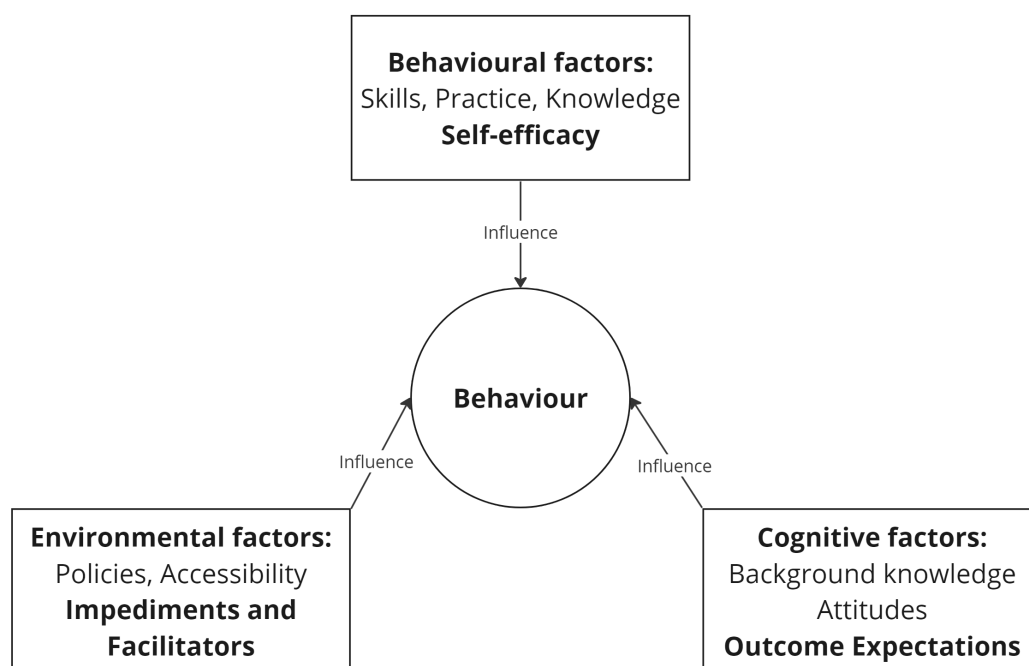


Figure 2.4 Overview of the Social Cognitive Theory (Kelder et al., 2015). The SCT model explains human behaviour in terms of 3 groups of factors: the behavioural factors (indicated by self-efficacy), the cognitive factors (indicated by outcome expectations) and the environmental factors (indicated by impediments and facilitators). These 3 groups interact to determine if an individual acts or maintains a behaviour.

In this model, behavioural factors are related to an individual's actual ability to perform a behaviour through essential knowledge, skills, and practices. To perform a planned behaviour, a person must know what to do and how to do it. This key driver is indicated using the self-efficacy construct. Self-efficacy is concerned with individuals' beliefs about their capacity to execute the behaviour (Bandura, 1997). It reflects the level of confidence of the individual to perform the behaviour in getting the desired outcome. High self-efficacy is associated with increased personal motivation and persistence, while low self-efficacy may result in avoidance or lack of effort.

Cognitive factors are associated with individuals' background knowledge and their attitude towards the final goal of the behaviour. To perform a behaviour, a person must set a goal and then attempt to execute the behaviour. Cognitive factors relate to the individuals' internal motivations. In this model, cognitive factors are determined by the outcome expectations construct. Outcome expectations are concerned with the individual's anticipated consequences to change (or maintain) that behaviour. Using background knowledge, people weigh the benefits and costs to form an attitude towards that behaviour. People with positive outcome expectations will increase the

likelihood of performing that behaviour, while negative expectations may deter that behaviour (DiClemente et al., 1985).

Environmental factors are linked to the sociostructural influence on individuals. When people perform a behaviour, they have to consider how easy it is to act under the current social context. For example, the extent of social approval (or disapproval) of abortion, the policies imposed to restrict smoking, and the cost of healthcare insurance. Environmental factors are modelled by impediments (barriers) and facilitators (opportunities) in that context (Bandura, 1997). The impediments and facilitators affect an individual's self-efficacy. Individuals will be inclined to perform behaviours that are facilitated (or approved) by society, while inclined to avoid behaviours that are constrained (or disapproved) by society. For example, people would feel more able to cycle if the community infrastructure is bike-friendly, and people would not be cycling if there were no cycling routes in the community.

The SCT provides a fundamental explanation of human behaviours and changes in behaviours. Self-efficacy, the level of the individual's ability to act, is the core construct of the SCT, determining whether or not an individual commits to the behaviour. Cognitive factors influence people's perception of ease to perform through outcome expectations, and environmental factors influence people's perception of ease to perform through impediments and facilitators in the environment (Luszczynska & Schwarzer, 2009). The model suggests that technologies can promote health behaviours in three ways: improving "self-efficacy", making individuals feel able to access healthcare services; changing the outcome expectation, making individuals aware of the benefits of the behaviour; and providing external support such as reducing barriers or introducing facilitators.

While SCT provides basic guidelines to introduce behavioural changes, this model is loosely organised. In this model, human behaviour is determined by the dynamic interplay between behaviour, cognition and environment. It does not specify the details of how changing in one aspect will influence other aspects, and how exactly changes in aspects contribute to the final change in behaviour. This is because this model was originally developed for learning behaviours, emphasising the fact that learning takes place and is maintained through observations and outcome reinforcement (Bandura, 1977). In addition, since it is a generalised model for all human behaviours, this model did not tie specifically to health behaviours. This may make it difficult to apply and operationalise this model in the healthcare utilisation context without any further detailed specifications.



### 2.3.3 Health Belief Model (HBM)

While SCT is a generalised model that aims to explain all human behaviours, the Health Belief Model (HBM) focuses exclusively on the context of health behaviours. The HBM was initially proposed by Hochbaum (1958) and was refined over the years to understand why people did or did not engage in health-related activities such as health screening and vaccination (Kasl & Cobb, 1966; Becker, 1974; Rosenstock, 1974). The HBM explains health behaviour by attributing it to two aspects: the perceived threat and the evaluation of the health behaviour (Janz & Becker, 1984). Individuals who are under high threat of illness, and who believe that the health behaviour is effective in reducing the threat, are inclined to carry out that health behaviour. These two aspects are then mediated by modifying variables, self-efficacy (this concept taken from the SCT), and cues to action, to determine the likelihood of an individual to act or maintain a health behaviour. An overview of the HBM model is illustrated in Figure 2.5.

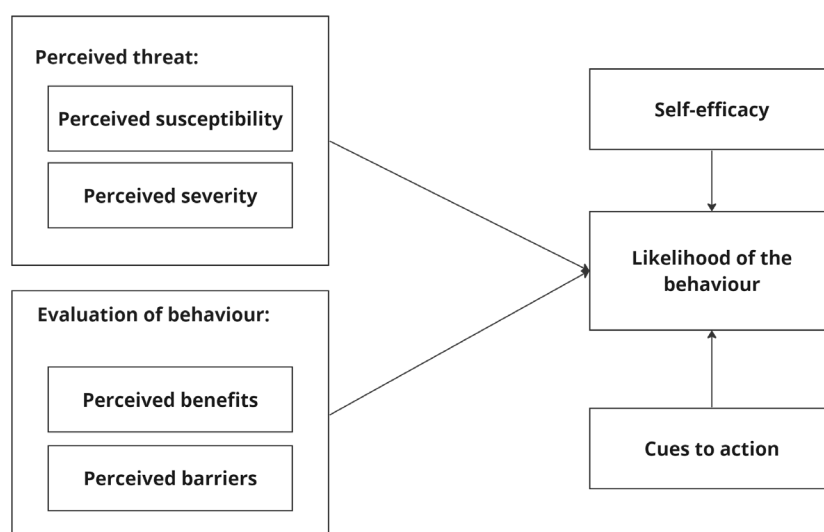


Figure 2.5 Overview of the Health Belief Model (Champion & Skinner, 2008). The health behaviour takes place by the individual's perceived threat of the illness and their evaluation of the effectiveness of the health behaviours in reducing that threat. Those two determinants are mediated by self-efficacy, i.e., the ability to perform the behaviour; and the cues to action, i.e., environmental triggers to perform the behaviour.

In HBM, the perceived threat of the illness is modelled by perceived susceptibility and perceived severity. Perceived susceptibility refers to one's feelings of vulnerability to a particular condition. If one believes that they are at risk, they are more likely to take action to address it. Perceived severity refers to one's feelings on the seriousness of the condition. If one feels the condition is severe, they are motivated to resolve the problem. The other construct, evaluation of behaviour, is modelled by perceived

benefits and perceived barriers. Perceived benefits are one's expectation of the effectiveness of the health behaviour in reducing the illness or threat. If one believes a health behaviour to be useful against the illness, they would be likely to carry out that health behaviour. Perceived barriers are the obstacles which prevent individuals from carrying out that health behaviour. One has to evaluate the cost and risk associated with that health behaviour. These four aspects primarily determine individuals' inclinations towards performing that health behaviour. In addition, this inclination is also affected by individuals' confidence to perform (i.e., self-efficacy) and event triggers to perform (i.e., cue to action) (Janz & Becker, 1984)

The HBM explains the health behaviours of individuals by specifying the cognitive process of engaging in health behaviours. This model is easy to operationalise since it is tied to specific healthcare contexts. The model suggests several ways to promote health behaviours: make people aware of the threat of an illness (i.e., inform about susceptibility), make them aware of the benefits of doing the health behaviour (i.e., inform about benefits), and reduce barriers to taking action (i.e., reduce costs of action).

While HBM is easier to operationalise than SCT, this model defines "perceived barriers" rather broadly. The obstacles which present to individuals are not specified. In addition, this model does not account for factors that exceed the targeted illness. For example, individual differences such as prior experiences (Jones et al., 2008) and personalities (Joyner et al., 2018) also influence people's decisions about health behaviours, but they are not specified in this model. Most importantly, this model does not consider the influences of the sociocultural environment on health behaviours. One's health behaviour can be influenced by collective health beliefs within the society, such as traditional medicine practices (Omorodion, 1993). This is particularly relevant to Chinese overseas students who commonly use TCM concepts and practices to manage their health and well-being, but this factor is not reflected in this model.

#### **2.3.4 Theory of Planned Behaviour (TPB)**

The Theory of Planned Behaviour (TPB) is another psychological model that explains human behaviours and changes in human behaviours. This is a cognitive model developed by Ajzen (1985, 1991) to predict an individual's intention to act upon behaviour in a dedicated context. It is one of the most influential models for explaining human behaviours and their changes (Ajzen, 2011). This model is applied in the health domain to explain a wide range of health behaviours, including smoking (Topa & Moriano, 2010), drinking (R. Cooke et al., 2016), exercising (Armitage, 2005),

consultation screening (Conner & Norman, 1994), as well as healthcare utilisation of specific conditions (C. Adams et al., 2022).

This model states that human behaviour is determined by the behavioural intent, i.e., the individual's intention to perform that specific behaviour. It is a cognitive representation of an individual's readiness to perform the given behaviour. The intent is affected by individuals' attitudes related to that behaviour, subjective norms, and perceived behavioural control. The overview of the TPB model is illustrated in Figure 2.6.

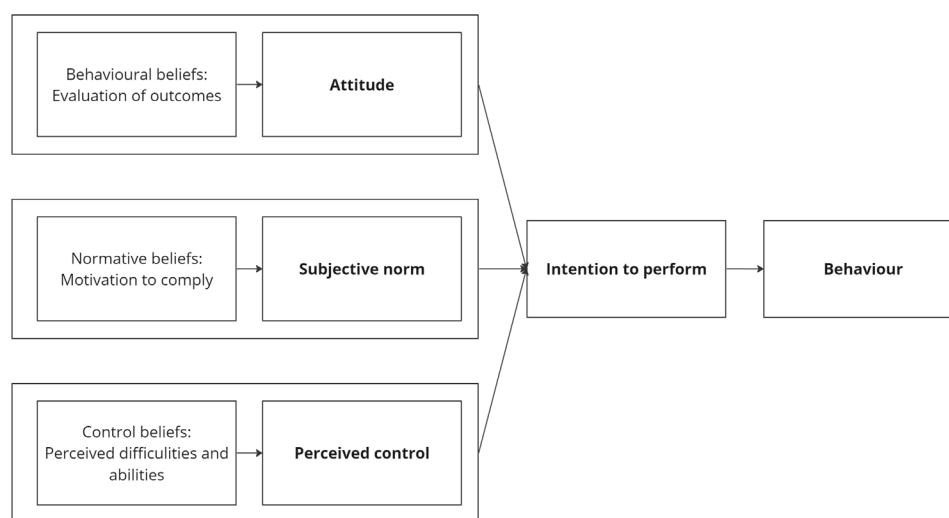


Figure 2.6 Overview of the Theory of Planned Behaviour (Montaño & Kasprzyk, 2015). The model suggests that human behaviour is determined by the intention to perform that behaviour. The intention is influenced by 3 aspects: the individual's attitudes, the subjective norm, and the perceived control. These aspects can be measured in terms of different types of personal beliefs: behavioural beliefs, normative beliefs, and control beliefs respectively.

In the TPB model, the construct of individuals' attitudes is indicated by behavioural beliefs. This relates to the expected outcome, risks, and benefits of performing that behaviour. This is similar to the "evaluation of behaviour" component in the HBM (c.f. Figure 2.5), where individuals assess benefits and costs to form a favourable or unfavourable attitude toward the health behaviour. The subjective norm refers to how other people think about the behaviour. If other people are strongly in favour towards the behaviour, one might feel compelled to perform that behaviour. This construct is measured by normative beliefs, the individuals' perception of other people's attitudes to perform that behaviour, i.e., motivation to comply. The perceived control describes the difficulties for individuals to perform the behaviour. People might feel discouraged if the behaviour is difficult to perform. This construct is measured by control beliefs, the individual's perceived difficulty or confidence in performing that behaviour. This is similar to the concept of "self-efficacy" in the SCT.

The TPB model suggests a behaviour initiates if: 1. The individual believes that the benefit outweighs the costs and risks of performing the behaviour, i.e. change in the personal attitude. 2. The individual feels that other people around them expect and encourage them to perform that behaviour, i.e. change in the subjective norm. 3. The individual believes that they can perform the behaviour at ease, i.e. change in perceived control. This model has proven to be effective in guiding changes in health behaviours (Steinmetz et al., 2016).

Similar to HBM, the TPB is easy to operationalise as it provides details of its constructs for people to measure. Ajzen also offered detailed guidelines for setting up questionnaires to measure changes in behaviour (2002a, 2006). Although the TPB is not specifically designed to explain behaviours in health contexts, it borrows core ideas from the SCT (i.e., self-efficacy) and HBM (i.e., evaluation of behaviour) while also taking account of the influence of the social environments (i.e., subjective norms) (Ajzen, 2002b). This model is particularly relevant to Chinese overseas students in utilising healthcare services because the model is not tied to specific illnesses, as people can use healthcare services for various reasons. It takes into account individual differences because all the constructs in this model are measured by individual perceived beliefs. Most importantly, it considers the influence of the social environment, which guides us in examining how Chinese overseas students influence each other and how TCM concepts influence their use of healthcare services. Researchers have used TPB to explain Chinese people's use of TCM in foreign countries (Rochelle et al., 2015).

## 2.4 Chapter Summary

In this chapter, I introduced the notion of health and well-being, health behaviours and healthcare service utilisation. People's health and well-being are about individuals' physical and mental state, and subjective feelings about their lives (WHO, 1946; The WHOQOL Group, 1995; Huber et al., 2011); people's health and well-being are affected by the behaviours which they perform, a.k.a., health behaviours (Renner, 2001). Using healthcare services is an important type of health behaviour as individuals need to know when, where and how to engage with healthcare services, and act to receive help from professionals.

Healthcare services utilisation is an interaction between the patient and the healthcare service provider, and it consists of multiple stages: starting from the awareness of discomfort and ending with obtaining the treatment outcome. Healthcare services are accessible if: the patient feels able to use healthcare services, and the healthcare service provider makes healthcare services obtainable (Levesque et al., 2013b).

However, as research shows, Chinese international students are less likely to use healthcare services (Sproston et al., 2001; Ellis-Bosold, 2013; Magnusdottir & Thornicroft, 2022). They face a number of barriers to utilising healthcare services in host countries. This includes shared barriers across immigrants, such as language, communication, socioeconomic status, and familiarity with healthcare systems. They also face barriers due to the Chinese sociocultural background, such as the influence of TCM, creating disparities in health beliefs and practices. Chinese international students also face barriers that are unique to their own, including psychological distress in academic environments, lack of social connections, lack of health information sources, lack of external support and drastic disparities in healthcare systems. Given those barriers, current research has demonstrated that Chinese international students feel reluctant to utilise healthcare services (Bertram et al., 2014; Ching et al., 2017; D. Wang, 2017). While current research primarily focuses on detailing Chinese students' acculturation process and mental health management (Wei et al., 2007b; A. W. Chen et al., 2009; Bertram et al., 2014; D. Wang, 2017; J. A. Chen et al., 2015; Ching et al., 2017; Law, 2021), a few studies also indicate that this trend also applies to broader areas of healthcare services, such as primary care (Ellis-Bosold, 2013; Porter, 2021). Therefore, further investigation may be needed to study their service utilisation behaviours that go beyond stress and mental health.

To reduce Chinese overseas students' reluctance to utilise healthcare services, I looked at popular conceptual models for behavioural changes, including the Behavioural Model and Access to Medical Care, the Social Cognitive Theory (SCT), the Health Belief Model (HBM), and the Theory of Planned Behaviour (TPB) to guide potential technology interventions. These models helped to identify key aspects of healthcare service utilisation and guide the design of technology. While the Behavioural Model and Access to Medical Care detailed the stages in healthcare utilisation, SCT explains key determinants for behavioural change; these two models are harder to operationalise compared to HBM and TPB in reducing Chinese overseas students' reluctance to healthcare utilisation. Compared to HBM, TPB is more relevant to this context because it does not tie to specific illnesses, and it takes into consideration health beliefs and social influences.

In this Chapter, I presented the process of healthcare utilisation and illustrated that Chinese overseas students are reluctant to utilise healthcare services. To introduce changes, I reviewed behavioural change theories from psychology and public health, showing key aspects that might potentially influence the decision-making process of Chinese overseas students in the context of healthcare service utilisation. In the next chapter, I will explain our approach towards addressing the design context, the Human-Centred Design (HCD) approach for designing dialogue systems that address Chinese students' reluctance in healthcare service utilisation.

## Chapter 3: Related Work and Design Approach

### 3.1 Introduction

In Chapter 2, I introduced concepts related to healthcare service utilisation and challenges that Chinese overseas students have in healthcare utilisation. In this chapter, I will present existing works which relate to the application of digital technologies in healthcare, particularly the use of dialogue systems. Then, I will present my approach to designing dialogue systems for addressing Chinese students' reluctance to use healthcare services.

The chapter has two parts: in the first part, I will introduce the concept of dialogue systems and their applications in healthcare contexts, particularly in their use of promoting health behaviours. I will explain why a dialogue system may be useful in supporting healthcare utilisations and how that is relevant to Chinese overseas students. The aim here is to provide an understanding of existing tools and explore design possibilities from relevant works.

In the second part, I will present our approach to designing a dialogue system to support Chinese overseas students. I will justify the general research methodology that we used to design the chatbot prototype, the Human-Centred Design (HCD), and explain the specific methods that we used in each of our studies for understanding, ideating, and evaluating the chatbot prototype. The methodologies mentioned in this chapter establish the scope of our research and guide our research directions throughout the thesis.

### 3.2 Dialogue Systems and Healthcare

#### 3.2.1 Types of Dialogue Systems

Dialogue systems are information systems designed to engage users with natural language conversations (Jurafsky & Martin, 2018). These systems commonly contain a linguistic component to process user inputs and generate outputs. Some dialogue systems also employ additional modalities such as speech, graphics, and gestures to simulate human conversations (Wolk et al., 2022).

Dialogue systems can be classified in many ways. For example, one approach is to categorise them by types of interactions. Dialogue systems can interact with users through text, speech, a combination of the two or through virtual embodied agents (also known as Embodied Conversational agents) or physical robots (M. McTear, 2021). Dialogue systems are also classified by the form of use. According to Jurafsky & Martin

(2018), dialogue systems can be either task-oriented or non-task-oriented. Task-oriented dialogue systems are those designed to carry out daily tasks, such as giving directions, controlling appliances, and booking appointments. These systems are also referred to as digital assistants e.g., Amazon Alexa, Apple Siri, Google Assistant, etc. Whereas non-task-oriented dialogue systems focus on carrying out extended dialogues to mimic human conversations, such as leisure talking, information retrieval and education. These systems are sometimes referred to as chatbots, for example, conversational bots used in social media, Microsoft Xiaolce (L. Zhou et al., 2020), and ChatGPT (OpenAI, 2023).

The core aspect of the dialogue systems is how they process conversations. One approach is to use hand-crafted rules to recognise and generate dialogue content. Dialogue systems using this approach are called rule-based dialogue systems. In general, systems of this kind use a set of “if-else” rules to recognise human inputs and generate outputs based on pattern matching. Once the user inputs a message to the system, the system simply looks up rules that match the input message and then outputs pre-written responses from the database. Since rules are pre-determined, it does not allow flexibility. It requires a lot of human effort and intelligence to build rules for achieving open conversations to some degree (M. McTear, 2021). Despite its inflexibility, this type of dialogue system is still used in many fields because they do not require any training or learning. Also, people have full control of conversation flows in this type of system, as all interaction rules and responses are human-crafted. This enables people to design dedicated conversations for specialised needs.

Another approach is statistical-driven. The main idea of this approach is to use probability theory with linguistic knowledge to process and generate responses. This kind of dialogue system generally uses a pipeline to transform user utterances into machine-readable logic, and then generate machine-readable logic to human-readable outputs (T. Bickmore & Wallace, 2022). Here, the automatic Speech Recognition (ASR) transcribes users’ speech into text. Texts are then decomposed into semantic notations (such as intentions and slots) using Natural Language Understanding (NLU) techniques. Semantic notations are then processed by the dialogue manager to determine the appropriate response. This response is then constructed into human-readable sentences by Natural Language Generation techniques. Some dialogue systems then transform those sentences back into speech using Text-to-Speech (TTS) techniques. All techniques mentioned here are determined by probabilistic predictions. These systems can handle more flexible user inputs compared to rule-based systems, as they predict the most probable output response from the user input. However, it requires training and learning, and it gives fewer possibilities for humans to fine-tune, as the output generation is determined by probabilities.

One popular approach that has emerged in recent years is to use deep-learning techniques and end-to-end architectures to build dialogue systems. Under this approach, users' inputs are directly fed into neural networks, and then the neural network automatically generates output sentences. There are no pipelines for translating user utterances to semantic logic and then to output responses. Instead, users' utterances are encoded as sequences of vectors, e.g., the Word2Vec technique (Mikolov, Chen, et al., 2013; Mikolov, Sutskever, et al., 2013). These vectors are then fed into neural network architectures to generate responses. The encoder-decoder architecture, a widely used neural network architecture, first compresses vector inputs into a dense representation, and then generates vector outputs based on the dense representation sequentially (Vaswani et al., 2017). In addition, some dialogue systems of this kind incorporate reinforcement learning techniques to make the conversation more logical and readable, such as learning from adjusting answers based on human feedback (Ouyang et al., 2022). Compared to other approaches, this approach can handle open conversations while not requiring explicit rules or linguistic decompositions. In this regard, it reduces human efforts to craft responses, but at the same time, it requires large, high-quality corpora to make the training and learning meaningful. Additionally, this approach generates outputs that it is hard for humans to control (T. Bickmore & Wallace, 2022). Dialogue systems of this approach often generate answers that are nonsensical or inaccurate (AI hallucinations), e.g., making up references in academic writings (Athaluri et al., 2023). At the current stage, it is challenging for humans to fully prevent this phenomenon from happening (Y. Zhang et al., 2023).

### **3.2.2 Dialogue Systems in Healthcare Contexts**

Dialogue systems have been applied widely in the field of healthcare. Historically, ELIZA (Weizenbaum, 1966) is one of the earliest attempts to simulate natural language interactions. Specific to healthcare applications, dialogue systems were successfully employed to aid individuals in managing mental health issues (Slack, 2000). For example, systems that coach people to conduct Cognitive Behavioural Therapy to alleviate depressive symptoms (Colby, 1995; Fitrianie et al., 2015). Dialogue systems have also been applied beyond the use of psychotherapy (Laranjo et al., 2018), showing their potential to support individuals by various means in managing health and well-being (T. Bickmore & Giorgino, 2006). Kearns et al. (2019) grouped dialogue systems in healthcare into five application domains: supporting clinical processes, supporting mental health management, medical education, patient education, and promoting behavioural changes.



One common application is to use dialogue systems to assist clinicians in monitoring health conditions. They have been used to track key health indicators such as heart rhythm (T. W. Bickmore et al., 2018), somatic feelings (Galescu et al., 2009) and sleeping patterns (Rick et al., 2019). Some dialogue systems also specialised in tracking specific illnesses, such as asthma (Rhee et al., 2014), depression (Farzanfar et al., 2007; Philip et al., 2017), excessive daytime sleepiness (Philip et al., 2014), post-traumatic stress disorder (PTSD) (R. Xu et al., 2012) and attention-deficit/hyperactivity disorder (ADHD) (Håvik et al., 2019).

For mental health management, one common application is to use dialogue systems to track users' daily moods. Woebot (*Woebot Health*, 2023), a popular commercial mobile app that guides Cognitive Behavioural Therapies, incorporates the feature of daily routine interviews to elicit users' feelings. Based on the tracked moods, it adjusts its therapies to best fit the user's needs to reduce stress. Some dialogue systems are also able to produce diagnostic reports and send them to clinicians to assist in the screening process (Burton et al., 2012; DeVault et al., 2014). In addition to tracking, dialogue systems are used to train patients to overcome problems such as autism. Dialogue systems are used to emulate humans and help patients learn how to speak (Cooper & Ireland, 2018), gain pragmatic skills, e.g. job interviews (M. J. Smith et al., 2014), and become familiarised with non-verbal cues in daily communications (Cooper & Ireland, 2018).

For medical education, dialogue systems are used as virtual patients to train medical students and healthcare workers. Virtual patients were developed for a variety of purposes. For example, systems designed to enhance the diagnosis and screening skills of medical students (Stevens et al., 2006; Isaza-Restrepo et al., 2018), mental health assessments of social care workers (Washburn et al., 2016), communication skills of clinicians (Ali, 2019) and cultural awareness of nurses (Sakpal, 2012).

For patient education, dialogue systems have been used to assist individuals in making sense of symptoms. Mobile apps such as Ada (*Health. Powered by Ada.*, 2023) interact with the patient to pre-assess symptoms to figure out potential causes of conditions. Some also linked with the healthcare provider's system to speed up triage (*Babylon Health UK*, 2023). These systems chat with the patient to figure out potential diseases that they are experiencing, and thus help them to decide what to do next (e.g., whether to visit the GP, urgent care unit or the emergency department, etc.) (Ghosh et al., 2018). If the system links to the healthcare provider, doctors can look at pre-assessment results to make sense of the case before the patient's visit (W. G. Adams et al., 2014). Dialogue systems are also used to enhance patients' health literacy. For example, systems used as virtual doctors to instruct and remind patients what to do after discharge (T. W. Bickmore et al., 2009). They are also used as educators for patients to understand illnesses and related matters (Bibault et al., 2019; Crutzen et al., 2011). Wong et al. (2012) developed a Frequently Asked Questions (FAQ) dialogue

system that interacts with users to address their medical concerns. In their implementation, the medical knowledge was extracted from answers in online community platforms, and the system presents relevant pieces of medical knowledge according to users' requests.

### **3.2.3 Dialogue Systems for Promoting Changes in Health Behaviours**

One application of dialogue systems is to support individuals in promoting health behavioural changes (Pereira & Díaz, 2019). One approach is through persuasion (T. Bickmore et al., 2007; Schulman & Bickmore, 2009). For example, Florence (Y. Kang et al., 2015), a dialogue system that simulates a virtual nurse to encourage exercise and healthy eating for older people. It incorporates the Elaboration Likelihood Model, a conversational strategy that generates convincing messages based on the response of users' behaviours. Another approach is to use dialogue systems to assist users in setting goals and formulating healthy habits. Ally, a daily step-tracking app, has a built-in chatbot to guide users to set their goals. The system helps the user to set up realistic goals through dialogue interactions, detailing when, where, and how to achieve these goals (Kramer et al., 2020). Piao et al. (2020) developed a chatbot system to help people maintain physical exercise. In addition to goal setting, they implemented the chatbot with compliment messages, picture sharing, and coupon giving to boost both intrinsic and extrinsic motivations to continue daily exercises.

Apart from promoting healthy behaviours, dialogue systems are also used to discourage unhealthy ones. For example, smoking cessation. Early examples, such as Velicer et al. (1993) implemented the dialogue system as a counselling expert. The system generates informational facts and motivating or reflective comments for people to reconsider the harmful aspects of smoking. Newer applications, such as Dubosson et al. (2017) incorporate the chatbot with interactive activities such as group chats and smoking image classifications to distract people from the smoking urge. Prochaska et al. (2021) adapted the Woebot infrastructure to monitor, interview and coach people to reduce their reliance on substances. Results showed that participants were likely to engage with the chatbot to disclose their substance use behaviours and follow the instructions to reduce their substance use.

Some dialogue systems also work collaboratively with sensors to facilitate critical reflections on health behaviours. Kocielnik and Hsieh (2018) developed the "Reflection Companion", a mobile app which collects fitness data and chats with users through mini-dialogues. Through the "noticing, understanding, future action" conversational paradigm, the dialogue system guides the user to make sense of the fitness data and triggers critical reflections by asking questions about planning future actions.

### 3.2.4 Towards a Dialogue System for Supporting Chinese Overseas Students' Healthcare Service Utilisation

As shown in Section 3.2.3, dialogue systems support health behaviour changes in many ways. According to a recent report, dialogue system-based interventions are effective in many domain applications across different populations to promote behaviour changes, including (but not limited to) physical activities, diet, sleeping, and smoking cessation (Singh et al., 2023).

Pereira and Díaz (2019) summarised a number of benefits of using dialogue systems in promoting behavioural changes. For example, asynchronicity (the ability to react and prompt), scalability (the ability to be used on a large scale at low cost), anonymity (the ability to keep confidentiality), personalisation (the ability to adapt personalised needs), etc. Similarly, Bickmore and Giorgino (2006) argued that dialogue systems exhibit unique factors in healthcare communications, such as providing on-demand support, continuous monitoring, and building rapport.

For the purpose of the thesis, I will highlight three key characteristics of dialogue systems that are most relevant to Chinese overseas students in supporting their healthcare utilisation problems: accessibility, interactivity and the potential to promote behaviour change.

First, dialogue systems are more accessible compared to human agents. Users can engage with dialogue systems regardless of time and space. This is relevant to Chinese overseas students as a dialogue system can answer their questions promptly. As mentioned previously, Chinese overseas students may not be familiar with healthcare services in the UK. While prior education may not be enough to address issues that students encounter when they feel uncomfortable, a dialogue system can answer their questions immediately. Also, dialogue systems can be easily embedded into existing social platforms and can be used across different devices (Pereira & Díaz, 2019). This simplifies how students can interact with dialogue systems. Students can choose to interact with dialogue systems through the platform that they are already familiar with.

Second, dialogue systems are interactive. Users can ask a variety of questions to a dialogue system, and the system responds with tailored information. This is relevant to Chinese overseas students because their service utilisation problem is multidimensional. Chinese overseas students require many types of information in order to address their concerns. For example, some students may just come to the UK and thus not familiarise themselves with the registration process. They need information to guide them through registering with GPs. Others may have registered but may not be familiar with UK medicines. They need information about UK medicines. Some others may assume the healthcare system in the UK functions the same as it

does in China. They need information about treatment and the referral process. Compared to official websites such as NHS (*NHS Scotland*, 2023), dialogue systems can provide information that is most relevant to students' specific contexts; compared to website searches, dialogue systems can give concise answers from official sources in real time. Students are less likely to engage with misinformation from non-trustworthy sources.

Third, dialogue systems display good characteristics to promote behavioural changes, particularly their capabilities in persuading and motivating users. The previous section has illustrated how dialogue systems can promote and discourage health behaviours. Since dialogue systems mimic human conversations, they can exploit conversational strategies to influence users' attitudes, and thus promote behavioural changes (Cialdini et al., 1981).

Many conversational approaches can influence users' attitudes. One popular approach is to persuade by providing health information, such as showing the potential harms and benefits of the behaviour to the user (Schulman & Bickmore, 2009; Carfora et al., 2020). Different from standard health messages, which are shown as advertisements, dialogue systems can distribute health messages more interactively (Shan et al., 2022). This is relevant to Chinese overseas students because dialogue systems can be used to nudge Chinese students, e.g., clarifying the benefits and outcomes of utilising healthcare services when they feel reluctant to use healthcare services.

Another approach is to motivate users through interactive coaching (Fitzpatrick et al., 2017; Stein & Brooks, 2017; Prochaska et al., 2021). Dialogue systems can instruct users in a step-by-step manner to reduce barriers to acting that behaviour. Dialogue systems can deliver personalised messages that address the user's needs, e.g. when conducting CBT, dialogue systems can adapt their instructions and the use of languages based on users' moods (Fitzpatrick et al., 2017). This is relevant to Chinese overseas students as dialogue systems can provide personalised instructions to address specific problems of individuals. If a student is confused about where to seek help, the dialogue system may instruct the student to find the right service. If a student feels hesitant to use healthcare services because of Western medicine, the dialogue system can affirm its effectiveness and encourage the student to use UK services.

Moreover, dialogue systems have the potential to trigger critical reflections. Dialogue systems can ask open questions about users' behaviour to trigger deeper thinking (M. K. Lee et al., 2015; Kocielnik et al., 2018). Through questioning, dialogue systems help users to reflect on their own needs and motivations in conducting health behaviours (Kocielnik, 2021). This is relevant to Chinese overseas students as dialogue systems help to clarify students' intrinsic motivation for using or not using healthcare services.

Dialogue systems are accessible to students; they are interactive to provide tailored information that addresses specific concerns; they are also capable of influencing

attitudes. Given these good characteristics, I think that dialogue systems (chatbots) have the potential to address the challenge of Chinese overseas students' healthcare service utilisation.

### 3.3 Human-Centred Approach for Chatbot Prototype Design

This section serves to justify our research approach throughout the thesis. I utilised Human-Centred Design (HCD) methodologies to achieve our aim of developing dialogue systems to help Chinese overseas students' healthcare utilisation.

HCD is a design approach that aims to address challenging problems and design innovative solutions by placing the user, their needs and requirements at the centre of the design process, ensuring the designed interactive system is usable and useful to the user (International Organisation for Standardisation, 2019). According to IDEO's field guide to HCD (2015), the HCD process consists of 3 phases: the understanding phase (c.f. Chapters 4 & 5), where the focus is to understand the target user group and the context of the challenge; the ideation phase, where the focus is to identify design opportunities and generate ideas for design (c.f. Chapter 6); the implementation phase, where the focus is to implement and evaluate the solution (Chapters 7 & 8). The full process is illustrated in Figure 1.1.

The HCD approach includes a great number of techniques. One common classification is by the form of data collection. For example, qualitative methods such as interviews, quantitative methods such as surveys, and design-specific methods such as co-creation sessions (Göttgens & Oertelt-Prigione, 2021). They can also be categorised by the purpose of use. For example, behavioural and modelling data to capture human behaviour, narrative interview data to capture needs and values, and imaginary discussions and activities to simulate possible futures (Giacomin, 2014). The HCD approach offers a constructive and experiential process to tackle challenges involving humans and the context (K. Chan, 2018). This approach is particularly effective in addressing patients' problems in healthcare settings because it centres on problem-solving while prioritising patients' needs (Göttgens & Oertelt-Prigione, 2021).

The HCD approach fits our research aim because we want to build a chatbot prototype that meets Chinese overseas students' needs in utilising healthcare services in the UK. To do this, we need to investigate Chinese overseas students' behaviours in managing their health and well-being, to understand the reasons behind their decisions to use or not use healthcare services in the UK. We also need to identify the pain points of Chinese overseas students in their healthcare service utilisation process to come up with solutions. We also need participants' input to evaluate the effectiveness of the chatbot prototype. The HCD approach provides us with a toolkit to understand the

context, identify needs, and test out the effectiveness of the intervention. Following the HCD process ensures we design the chatbot prototype in a way that tailors to Chinese overseas students' needs, providing concrete improvements to current situations.

### 3.3.1 Context Understanding: Grounded Theory

I used the Grounded Theory approach to understand Chinese overseas students' behaviours in managing health and well-being and their decisions to use healthcare services. Grounded theory is a systematic qualitative research method, or “a set of principles and practices”, that aims to derive social explanations from empirical data (Corbin & Strauss, 1990; Charmaz, 2006b).

This method is a constructivist paradigm (bottom-up approach) that moves beyond simple descriptions of a phenomenon, aiming to derive explanations from empirical data. This approach usually starts with data collection and derives explanations through constant data comparison and iterative data collection. The knowledge is constructed inductively from empirical data rather than deductively from the literature (Collins, 2018).

According to Charmaz (2006b), the Grounded theory method is an iterative process that typically involves gathering rich data, iterative qualitative coding, memo writing, and theory construction. However, the implementation of the study design can be flexible. Charmaz (2006b) regards the Grounded theory method as “flexible guidelines” rather than “prescribed requirements”. For example, the data collection source can be interviews, observations, documentation or combinations of these, and the research process, such as qualitative coding, memo writing and theory construction, can be conducted in a non-linear order. In principle, the researcher's role in the Grounded method is to iteratively collect rich data and reflect on the data to produce theoretical explanations of a phenomenon. Urquhart (2013) summarised 12 key characteristics of Grounded theory research (Table 3.1).

Table 3.1 Key characteristics of the Grounded theory method (Urquhart, 2013)

|                                                                                                  |
|--------------------------------------------------------------------------------------------------|
| The Grounded theory method aims to generate or discover a theory.                                |
| The researcher has to set aside theoretical ideas in order to let the substantive theory emerge. |
| The theory focuses on how individuals interact with the phenomena under study.                   |
| The theory asserts a plausible relationship between concepts and sets of concepts.               |
| The theory is derived from data acquired from fieldwork interviews, observations and documents.  |
| Data analysis is systematic and begins as soon as the data is available.                         |
| Data analysis proceeds by identifying categories and connecting them.                            |
| Further data collection (or sampling) is based on emerging concepts.                             |

|                                                                                                                                                                            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| These concepts are developed through constant comparison with additional data.                                                                                             |
| Data collection can stop when no new conceptualisations emerge.                                                                                                            |
| Data analysis proceeds from open coding (identifying categories, properties and dimensions) through selective coding (clustering around categories) to theoretical coding. |
| The resulting theory can be reported in a narrative framework or a set of propositions.                                                                                    |

I chose to use the grounded theory method because it offers a systematic way to investigate Chinese overseas students' health management and their use of healthcare services. Compared to other analytic methods, such as thematic analysis, it analyses data bottom-up. Since there are a variety of theories about changes in health behaviours (Section 2.3), this method enables me to choose the theory that best fits the Chinese students' context. It addresses RQ1, "How do Chinese overseas students make decisions about using healthcare services in the UK?"

From Section 2.2, we know that there are many challenges for Chinese overseas students to utilise healthcare services; however, the factors that cause this phenomenon are not being examined systematically. Grounded theory provides a way to understand this phenomenon without making prior assumptions. By scrutinising students' experiences in rich contexts, I was able to choose the best theoretical framework that best explains Chinese students' healthcare utilisation behaviour. This is important because the output of the Grounded theory study will guide the direction of the chatbot design.

### 3.3.2 Ideation: Co-design Workshop

I used the Co-design workshop to identify the design opportunities and design requirements of Chinese overseas students' healthcare journeys in the UK. Co-design is a set of research practices commonly used in service design to identify users' pain points and discuss ways to improve them (MacDonald, 2012). Specific to workshops, stakeholders come together to participate in design activities. The goal is to make sense of the situation and to develop conceptual solutions that address matters of concern, thus improving the current situation (Zamenopoulos & Alexiou, 2018). Co-design is a commonly used research paradigm in the field of Human-Computer Interaction. This approach was originally used to bring users' voices to solve usability problems (Carroll & Rosson, 2007). Later, it was also used to explore design opportunities and design requirements to reflect users' needs and wants (Sanders et al., 2010).

The co-design method is used widely in healthcare research to investigate patients' care experiences. One commonly used protocol is called Experience-based Co-Design (EBCD) (The Point of Care Foundation, 2016). This protocol incorporates stakeholders, including patients, carers and policymakers, to promote service improvements. In

EBCD, patients and carers reflect on their experiences of healthcare service, work together to identify improvements, find ways to make things better, and then jointly reflect on proposed solutions (Donetto et al., 2015). EBCD is widely used to develop and improve service quality or care routines (Green et al., 2020).

Bradwell and Marr (2008) defined the Co-design method in terms of 4 key characteristics: participation, development, ownership and power, and outcomes and intent. The explanation of each characteristic is illustrated in Table 3.2.

Table 3.2 The four characteristics of the Co-design research

|                                                                                                                                                                                                                                            |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Participation:</b> Co-design is a collaborative process in which all stakeholders are encouraged to participate in the design process and contribute to the design. (adapted from Donetto et al., 2015).                                |
| <b>Development:</b> Co-design is a developmental process. It involves the exchange of information and expertise relating to both the subject of the design process (stakeholders) and the design process itself.                           |
| <b>Ownership and power:</b> Co-design involves a transformation of ordinary power relations between stakeholders and aims to generate collective ownership. (adapted from Donetto et al., 2015)                                            |
| <b>Outcomes and intent:</b> Co-design activities are outcome-based. They possess a practical focus, with clarity of vision and direction. Methodology and implementation seek to ensure a shared creative intent between all participants. |

I chose to use the Co-design method because it offers a good way to elicit Chinese overseas students' needs and wants in healthcare journeys and investigate design opportunities of chatbots to support them in utilising UK services. This method was used to address RQ2, "How can a chatbot be used to address problems that Chinese overseas students have in their use of healthcare services in the UK?"

Through Co-design activities, we provide our target users with an opportunity to reflect on the pain points in their health journeys and think about potential chatbot interventions that might be useful for them. The insights from participants help us to recognise design opportunities and formulate design solutions.

### 3.3.3 Evaluation: Wizard of Oz Experiment

I used the Wizard of Oz (WoZ) method to evaluate the effectiveness of the chatbot prototype which aims to support Chinese students' healthcare service utilisation. The purpose is to set up a pre-and post-experiment to examine the effect of the chatbot interaction on Chinese overseas students in their intention to utilise healthcare services in the UK. WoZ is a well-known research method to investigate users' interaction with intelligent systems (Ramaswamy, 2023). The name "WoZ" is derived from the novel "The Wonderful Wizard of Oz" (Baum, 1900), where a man hides



behind a curtain and uses technologies to create the illusion of being a powerful wizard. The term WoZ was first used by Kelly (1984) in studying the usability of dialogue systems in office contexts, and it was then used as a formal research method to evaluate technologies and design prototypes.

In a WoZ experiment, the participant interacts with the “autonomous” system without any prior knowledge of how it works. At the same time, a human, i.e., the “wizard”, hides behind the system’s interface to simulate the “autonomous” system that does not yet exist or is not fully functional (Porcheron et al., 2021). In WoZ studies, the wizard generates responses according to pre-determined guidelines, procedures, or templates. Users’ interactional data is collected to investigate the usability of the system and explore its potential usefulness (Ramaswamy, 2023). WoZ systems can fall within a spectrum of closed-to-open, depending on the extent of freedom granted to the wizard. Wizards who simulate closed ones can only choose from a set of pre-defined actions to respond to the user, whereas wizards who simulate open ones can carry out whatever action they deem appropriate (Ramaswamy, 2023).

The WoZ provides participants with an “intelligent” experience and studies the experience without having to implement a system fully (White & Lutters, 2003). The WoZ technique is commonly used to study natural-language user interfaces to test novel design concepts and bring valuable insights to inform future designs (Schlögl et al., 2015). For example, Maulsby et al. (1993) employed this method to simulate a computer assistant that performs data-processing tasks to investigate how users issue speech instructions. Lee et al. (2017) used this method to gather design requirements for designing assistants for trip plans. Kirschthaler et al. (2020) used this method to simulate a food delivery application to explore the concept of “discoverability” in voice interaction interfaces. This method is also used to inform the design of conversational agents for leisure conversations (Bradley et al., 2009; Medhi Thies et al., 2017), agent-based recommendation systems (Avula & Arguello, 2020; Hernandez-Bocanegra & Ziegler, 2021), chatbots for conflict resolving and mediation (Salehzadeh Niksirat et al., 2023), and research data collection (M. X. Zhou et al., 2019). In healthcare contexts, the WoZ method is used to evaluate the potential effect of the conversational agent on the presentation and communication of health information (AMITH et al., 2019).

The WoZ experiment fits our goal in answering RQ3, “How has the chatbot we created impacted Chinese overseas students’ willingness to use healthcare services in the UK?” and its subsequent hypotheses because we want to investigate our chatbot prototype’s potential to improve Chinese overseas students’ reluctance in utilising healthcare services, particularly evaluating the effect of educational chatbots on those who have just arrived in the UK. The WoZ method allows us to test this idea at a low cost without implementing a fully functional system.

Chapter 8 describes a hybrid WoZ system for evaluation. The chatbot system responds to participants' messages automatically when participants ask pre-defined questions. If the user poses an open question that cannot be answered by the chatbot prototype, it redirects this question to the wizard to provide the answer manually. We used the hybrid approach because it reduces the wizard's workload in processing participants' inputs and maintains a consistent interaction experience for all participants. In the WoZ experiment, the participant interacts with the "real" chatbot for the majority of the time. The role of the wizard is to monitor the conversation and, if there is an open question, provide a short answer. This hybrid system minimises human errors and ensures the information provided by the chatbot is at a consistent level.

### 3.4 Chapter Summary

In this chapter, I described our approach to addressing Chinese overseas students' reluctance to utilise healthcare services in the UK, i.e., designing a chatbot to help them overcome barriers in the process of healthcare utilisation. I first introduced the concept of dialogue systems and different types of dialogue systems, on how they present and process conversations. Dialogue systems are widely used in the healthcare context, such as supporting clinical processes, mental health management, and educating medical students and patients (Kearns et al., 2019). Dialogue systems are also used to promote behavioural changes. Common techniques include persuasion (T. Bickmore et al., 2007; Schulman & Bickmore, 2009), goal-setting (Kramer et al., 2020), coaching (Dubosson et al., 2017; Prochaska et al., 2021), habit formulation (Piao et al., 2020), and monitoring and reflection (Kocielnik et al., 2018). These successful interventions made us believe that dialogue systems have the potential to change Chinese overseas students' behaviour in utilising healthcare services in the UK.

We used the HCD approach to design a dialogue system because we want to build a chatbot prototype that reflects Chinese overseas students' needs and addresses their pain points in utilising UK healthcare services. The HCD includes three phases: the understanding phase, the ideation phase, and the implementation and evaluation phase. These three phases address RQ1, RQ2, and RQ3 respectively.

In the understanding phase, we used the Grounded Theory method to understand Chinese students' healthcare management and their service use decision-making behaviour from the bottom up. The aim was to build an explanation of Chinese overseas students' use of healthcare services in the UK, identifying key elements that contribute to their decisions of use. In the ideation phase, we used the Co-design method to identify the needs and wants of Chinese overseas students for the use of UK healthcare services. This method helped us to elicit Chinese overseas students' thoughts on how a chatbot can be used to support them. In the implementation and evaluation phase, we used the WoZ method to evaluate the effectiveness of the

chatbot prototype that we designed. The WoZ method helped us to realise user-chatbot interaction at a low cost without much impact on examining the effectiveness of the chatbot prototype.

In this next Chapter, I will describe my first step towards understanding Chinese overseas students, an autoethnographic study of two healthcare utilisation experiences of my own.

## Chapter 4: Autoethnography Study

### 4.1 Introduction and Motivation

In Chapters 2 and 3, I introduced basic concepts related to: 1. Chinese overseas students about their difficulties in utilising healthcare services, 2. how dialogue systems can be used to promote health behaviours, 3. The HCD approach to address this problem. In this Chapter, I describe my first step towards the design, i.e., having an initial understanding of Chinese overseas students about their use of healthcare services. This chapter describes a preliminary investigation of the first research question listed in Chapter 1:

[RQ1] How do Chinese overseas students make decisions about using healthcare services in the UK?

I used an autoethnography to reflect on two of my personal experiences. As a Chinese overseas student who studied in the UK for 10 years, my experiences with UK healthcare services may be valuable to reflect upon. The motivation is to use my personal experiences as a starting point to explore attitudes, feelings, and behaviours that other Chinese students might also have in common. I conducted the autoethnography as a trial “interview” of myself in preparation for the interviews conducted in Chapter 4. In particular, this autoethnography study aims to:

1. Have an initial understanding of how Chinese overseas students use healthcare services and their experiences of managing their health in the UK, starting from my personal perspective.
2. Record themes that I have encountered when I use UK healthcare services. These themes will be used to form questions and used as prompts for upcoming interviews.
3. Develop empathy through introspective writing, specifically to develop awareness about my personal attitudes, feelings, and behaviours that may also apply to other Chinese overseas students.

### 4.2 Method

Autoethnography is well-established in qualitative research. Autoethnographic studies use anecdotes and personal experiences as the primary data source for reflections. The reflections often relate to self-observations and reflexive thinking of “culture” or “society” (Ellis et al., 2011), i.e., building up interpretations of personal experiences in

social contexts (Mills et al., 2010). In healthcare research, researchers used autoethnography to investigate health practices and illnesses experiences, e.g., caregiving (Kestenbaum et al., 2015; J. Smith, 2013), chronic illnesses (Spieldenner, 2014; Wilbers, 2015), mental health (Liggins et al., 2013; Fox, 2014), eating habits (Dewan, 2017) and pregnancy (Trussell, 2015). Researchers write down their experiences to reflect on experiences through their own lens.

I reflected on two healthcare utilisation experiences in the UK. The first was about an experience of visiting the emergency dentist. This was the first time I formally used healthcare services in the UK apart from buying over-the-counter medicines. The second one was an experience about visiting the GP for a minor but annoying problem. This was the first time I used the GP. I used monologues to describe my experiences. I also wrote down my feelings and reflections while I was narrating my experiences, trying to answer the question “Why was I reluctant to use healthcare services in the UK?”

The reflective writing was analysed by using the descriptive coding method (Saldaña, 2013), i.e., using short words or phrases to index and summarise the content in the reflective writing. These codes were also discussed with my supervisors. We identified an initial set of codes which other Chinese overseas students might also find challenging to deal with (see Figure 4.1) and formed five themes that relate to utilisation reluctance.

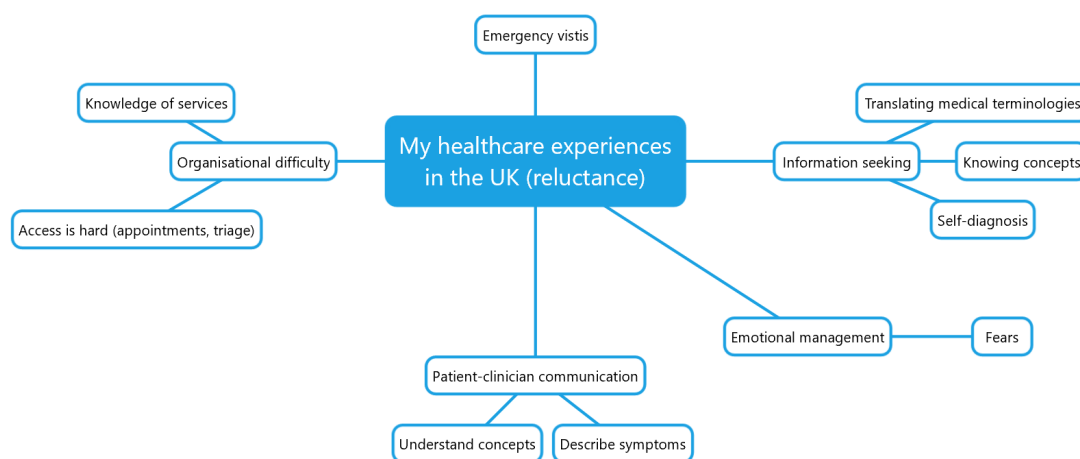


Figure 4.1 The themes that I felt difficult to deal with when using healthcare services. It is used as an initial set of themes for semi-structured interviews.

## 4.3 Results

### 4.3.1 Theme 1: Communication is an English problem, but also a knowledge problem

From the writing, I noticed that my reluctance comes from many sources. The most obvious one was the communication problem. I did not know the English words corresponding to body parts such as “cheek” and the name of the tooth.

However, I had some communication issues in describing where I felt pain (the left-hand side cheek) and the symptoms I had (swelling and some gum bleeding). I think I confused her due to the overuse of general terms, e.g. when she asked me which tooth I felt pain in, I did not know all the names of the teeth, I just told her at the back of my mouth. (Experience 1)

To mitigate this, I normally prepare in advance. “I looked up the keywords of my condition, i.e., gout, in a Chinese-English dictionary app before going to the GP” (Experience 2). I also used body language to let the doctor understand what I meant, e.g. pointing out the tooth in pain using the tongue (Experience 1).

However, the communication problem went beyond English. While talking to doctors, I sometimes did not understand the medical concept behind words, not even after translating them into Chinese. For example, I did not understand the concept of “wisdom tooth”. I knew it was a tooth but I did not know which tooth it was. I had to rely on the doctor’s explanation to make sense.

After she did a few checks, she used a term that I did not understand to describe my condition. When she saw my confused face, she changed her wording and told me that I had a “wisdom tooth” infection, an infection in the back of the mouth. (Experience 1)

This also happened when talking about medicines, where I did not understand the name of the medicine. “She prescribed me some medicine. I only knew that it was a type of antibiotic (Experience 1).” “He suggested me to take some medicine which I did not know (a type of painkiller) (Experience 2).” I had to ask doctors to write down their names, instructions and where I could buy them so that I could use the medicine in the right way.

For me, talking to doctors is the process of negotiating meanings. I need to prepare beforehand, look up words in English, use body language to point out body parts and ask for explanations for concepts that I did not understand. I would not go to these services unless absolutely necessary because I need to spend a lot of time and effort negotiating with the doctor.

I did not know all the names of the teeth, I just told her at the back of my mouth. Fortunately, thanks to the body language and the dictionary app, the dentist finally got the idea. (Experience 1)

We had some negotiation of meanings here: First, I lay down facing the roof, he said no, and then I turned upside down, and he said no again. At that point, I was really confused about what he wanted me to do but he eventually asked me to face upward. (Experience 2)

#### 4.3.2 Theme 2: I had limited knowledge about UK healthcare services

The UK healthcare system is drastically different from the Chinese system. People in the UK use their local GPs as their first contact point when they are ill, whereas people in China visit large hospitals when they are ill.

The healthcare system in China operates using the “insurance model”, whereas in the UK, the healthcare system is more complex (but free). While people living in China can just “walk in” to the hospital and finish within half a day, people living in the UK must make an appointment with their local GP and wait... [In China] People see clinics as an inferior substitute for hospitals (i.e., a social convention).

I knew healthcare services worked differently in the UK. However, I did not know how these services actually work. I had no idea about how to use them, in what context I could use them, and what would happen when to use them.

I had an acute toothache ... I did not know what to do at first, so I decided to Google what I should do. At that time, I was not aware of how emergency dentists work. All I learned online is that I should visit an emergency dentist. (Experience 1)

Particularly, I was confused about the role of the GP. At that time, I thought that I needed to book an appointment with the GP for all health problems, regardless of whether it was an emergency or not. I was also uncertain about what help I would receive from the GP.

I forgot where I initially registered my GP.... At that time, I was very worried that I would be refused to use any emergency services (in the future) as I forgot the details of my GP. (Experience 1)

At that time, I was also afraid of the uncertainties of using the GP (What if things go wrong? What if the GP cannot get what I mean?), so I decided to postpone. (Experience 2)

When it comes to health issues, I make health decisions cautiously. I would like to stick with my existing health management routine, i.e., take medicine that I brought from China, unless I am seriously ill, because I did not know how they work and how the UK healthcare services would benefit me.

#### 4.3.3 Theme 3: Searching for health information online requires demanding effort

Searching for health information online is the first thing that I need to do every time I am thinking of reaching UK healthcare services. There are two reasons, one is to make sense of the illness and its related terms, and the other is to look up the treatment procedure. I mainly use search engines as the primary tool to understand my discomfort. First, I would use Chinese to understand related terms and concepts and then translate these words into English to prepare for the screening.

I cannot walk properly.... the first thing I did was to search for my condition on the web (in Chinese – because I am not confident describing it precisely in English). After reading some top hits in Baidu (A Chinese search engine that I got used to), my condition seems to partially match the symptoms of gout.... I then used Google and searched for the descriptions of “gout” in English, to familiarise myself with the terminology (Google have better English results). (Experience 2)

I used the official NHS website to learn medical concepts (e.g., “gout”). The NHS website also lists the treatment procedure, which I found “very useful”. This helped me to anticipate how I would be treated.

However, the NHS website is not a diagnostic tool. I had to rely on other information sources to decide whether I needed to seek help.

According to Baidu, I noticed that gout is a chronic disease, and it is quite serious if I do not seek treatment.... [After reading through the NHS website], I was not completely sure if I got gout (as my condition did not fully match the description on the NHS website) ... [so I decided to go to the GP in the end, however,] this turns out the problem is just a minor muscular issue. Information that I read online (before I went to the NHS website) intimidated me. (Experience 2)

Doing online searching requires effort. Before I went to services, I searched both Chinese and English sources to understand the illness, translated and familiarised myself with relevant medical terms in English and built anticipation about the



treatment procedure. After completing all of that, I sought confirmation from other information sources to make a final decision.

#### **4.3.4 Theme 4: Going to healthcare services in emergencies is problematic**

I found it rather hard to seek professional help if I had urgent conditions. Under emergencies, I had no time to make sense of the illness and prepare for communication. I had to use general terms to articulate my symptoms as I did not know how to describe pain and body parts.

The conversation went well at first (I described my pain and she asked me when I had the pain); however, I had some communication issues to describe where I felt pain (the left-hand side cheek) and the symptoms I had (felt swelling and some gum-bleeding). I think I confused her due to the overuse of general terms. For example, I did not know all the names of the teeth; I just told her [the pain] is from the back of my mouth. (Experience 1)

Apart from the communication issue, I had no time to make sense of how emergency services work, and whether or not I need referrals to do so.

I did not know what to do at first ... all I learned online was that I should visit an emergency dentist.... The next morning, I went to that place with uncertainty, as I did not know what things I should do. The only thing that I knew at that time was to enter the building and ask someone for help.... I was very worried that I would be refused to use any emergency services as I forgot the details of my GP. (Experience 1)

Under emergencies, I had to use the service with zero preparation. I could spend a lot of effort to let the doctor know my symptoms, and I could run into organisational problems, such as not knowing what to do, and not knowing what to anticipate.

#### **4.3.5 Theme 5: The emotional resistance to using UK healthcare services**

In all of my experiences, there is some degree of emotional resistance when using healthcare services. Before the visit, I felt anxious and worried, and during the visit, I felt uncertain. Only after the visit, I feel relieved. This has to do with the stress of having the symptom, "I had no idea about what went wrong, so I felt quite anxious (Experience 2)." It also has to do with fears of the unknown. I felt stressed when I was booking an appointment with the GP because "I think the meeting must be booked

online or by telephone, and (I have heard that) it might take ages to arrange it (Experience 2).” While I was asking the receptionist to arrange an emergency consultation, I was so worried about getting refused as I forgot the details of my GP (Experience 1). It was not easy to conquer this feeling. I spent several days making up my mind to go to the GP.

[I felt swelling around the pinkie toe and ankles] The condition started on Tuesday, but I eventually decided to book an appointment with the GP by Friday.... At that time, I was also afraid of the uncertainties of using the GP (What if things go wrong? What if the GP could not get what I mean?), so I decided to postpone... [Eventually] On Friday morning, I went to the university’s GP with determination. (Experience 2)

In addition to the time and effort to make sense of the illness and the healthcare system, emotional effort was also required to attend healthcare services.

#### 4.4 Conclusion and Limitations

This autoethnography study showed that I am reluctant to use healthcare services in the UK, despite that I have lived in the UK for years. My reluctance is not only the result of English proficiency, but it also relates to the problematic process for emergency visits, the unfamiliarity with UK healthcare services (organisational difficulty), the difficulty in negotiating meanings with doctors (patient-doctor communication), the demanding effort to search and learn medical terminology and concepts (self-study), and the fears (emotional burden) to resolve the problem.

This study has some limitations. First, I only have 2 experiences with UK healthcare services so far, and no other materials were used for triangulation. My understanding of the context may be limited to the two experiences that I had. It may not be a comprehensive representation of other people’s feelings and thoughts. Second, to keep it simple, I only used the descriptive coding method (Saldaña, 2013) for analysis. This may not be a good representation of attitudes and beliefs, as descriptive codes lose the rich context. Methods like “In Vivo” coding would have a better representation as codes are directly taken from the source. Despite these limitations, it is still sufficient to develop some understanding of the context.

In this chapter, I reflected on two of my personal experiences in utilising healthcare services in the UK. Results showed that my reluctance comes from multiple sources: difficulty in orienting, difficulty in negotiating meanings with doctors, demanding effort to self-study medical terminology and concepts, as well as emotional fears. These themes serve as initial interview topics in Chapter 5.

## Chapter 5: Grounded Theory Study

### 5.1 Introduction and Motivation

This chapter describes a grounded theory study which investigates Chinese overseas students' health behaviour and, more specifically, their use of healthcare services in the UK. In Chapter 2, we know that Chinese overseas students tend to be reluctant to use healthcare services in the UK when they have health problems. In Chapter 4, I reflected on my personal experiences to get some initial thoughts about why I was reluctant to utilise healthcare services. In this Chapter, I explore how other Chinese overseas students manage their health and how they use healthcare services in the UK. The aim is to systematically understand how Chinese overseas students make decisions when they feel discomfort. The output of this study is an explanatory framework: going beyond a description of the phenomenon, which serves as a foundation to make design changes.

This chapter answers the first research question listed in Chapter 1.

[RQ1] How do Chinese overseas students make decisions about using healthcare services in the UK?

To answer the [RQ1], the following sub-questions were investigated:

[RQ1.1] How do Chinese overseas students manage health and well-being in the UK? In particular, what do they do when they feel discomfort?

[RQ1.2] What are the attitudes that Chinese overseas students hold towards UK healthcare services?

[RQ1.3] What kind of underlying difficulties prevent Chinese overseas students from using healthcare services in the UK?

To answer the above questions, I used the Grounded theory method to iteratively interview 11 students about their healthcare experiences in the UK. By the end of this chapter, I accomplished the following things:

1. Collected a comprehensive set of materials about Chinese overseas students' healthcare experiences in the UK, with a particular focus on healthcare service utilisation. This includes but is not limited to access to the GP, dentists, pharmacies, mental health counselling services, and hospital specialists.
2. Developed an explanatory framework about Chinese students' healthcare service utilisation behaviour in the UK.

The results show that Chinese students' healthcare service utilisation relates to five aspects: "Perceived difficulties to use", "Attitude towards UK healthcare services", "Social influence", "Direct motivation to use", and "Post-decision behaviours". In these 5 categories, "Perceived difficulties to use", "Attitude towards UK healthcare services", and "Social influence" are the three key determinants for healthcare service utilisation. Together with the context category "Individual and Situational-specific Factors", these four categories determine the last category, "Post-decision behaviours", i.e. how Chinese students manage discomfort.

Findings from this study outlined the design implications to promote changes. To encourage healthcare service utilisation, a design should improve self-efficacy, i.e., reduce perceived difficulties in using healthcare services; or change students' attitudes towards healthcare services, i.e., raise awareness of how healthcare services can help, or increase social influence in Chinese students' community, i.e., establish an informative and supportive social environment where individuals can seek help easily.

## 5.2 Method

### 5.2.1 Study Design

As mentioned in Section 3.3.1, we followed Charmaz's (2006b) approach to conduct the Grounded theory study. Interviews were conducted iteratively, in the form of unstructured interviews. After each interview, we revisited the interview to see if any new topics had emerged. We continued to interview new participants until no new topics had emerged, i.e., all topics were re-encountered repetitively and no more new topics emerged. At this point, we claimed that the data had reached saturation. For data analysis, we conducted two iterations of formal qualitative coding analysis (i.e., first iteration: initial coding, second iteration: focused and axial coding). Memo writing and constant comparison of transcript annotations are used to determine whether the data has reached saturation. The steps of data collection are shown in Figure 5.1 and the steps for data analysis are shown in Figure 5.3.

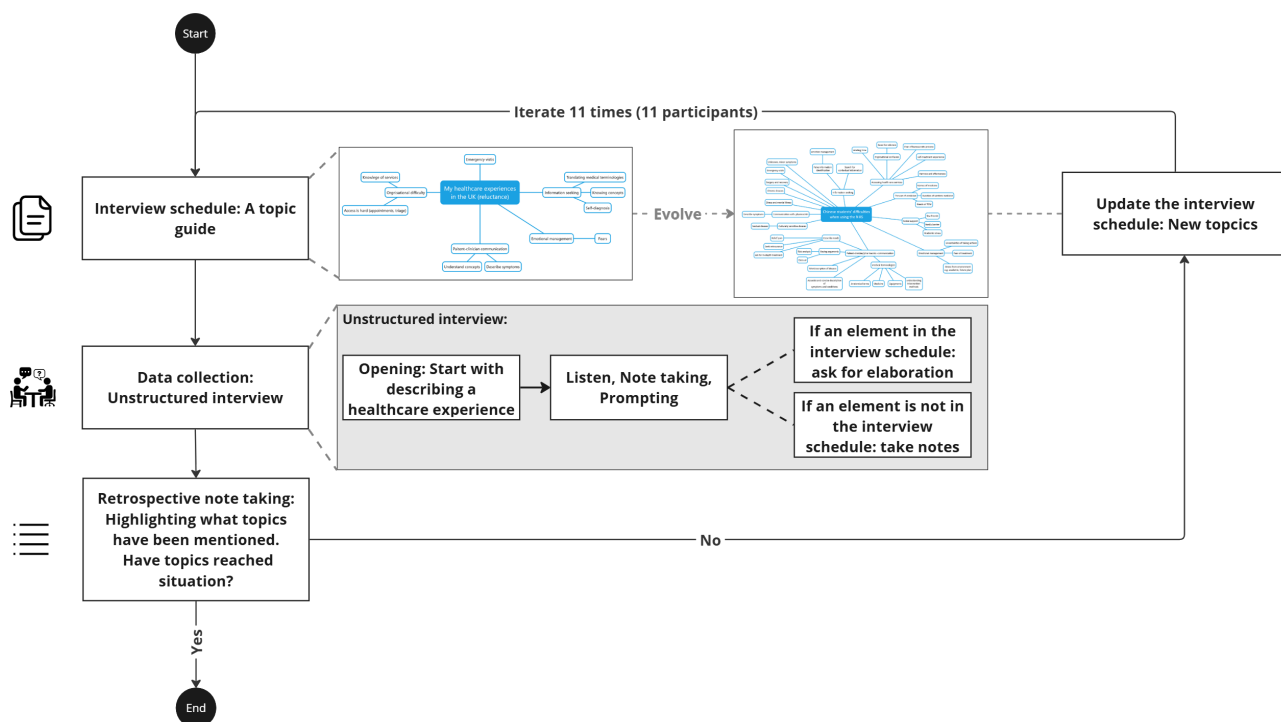


Figure 5.1 Grounded theory data collection process: Iterative interviews.

We used the themes from autoethnography as the starting point of the interview schedule. The version of the initial interview schedule contains 5 broad themes: students' prior knowledge of UK healthcare services, their information-seeking behaviour, their experience of urgent or emergency conditions, patient-doctor communication, and emotion management. All these themes are retrieved from the autoethnography study. For each of the interviews, we first asked the interviewee to describe a healthcare experience that they had had in the UK (i.e., open beginning). After that, we prompt them to elaborate on specific behaviours and their thoughts (i.e., listening and prompting). Interviewees were also encouraged to talk more about topics that were not listed in the interview schedule. While the interviewee was speaking, the interviewer constantly checked the interview schedule to identify new topics (i.e., take notes). New topics were also prompted for elaboration. At the end of the interview, the interviewer and the interviewee worked together to summarise and reflect on interesting discoveries. For example, one interviewee identified that "peer influence" plays an important role when they consider visiting healthcare services. After the interview, the interviewer writes reflective memos. The aim is to document new topics and compare them with existing topics. Before starting a new interview, the interviewer rearranges new topics and existing topics in hierarchical order and then updates the interview schedule (i.e., evolve). For example, the initial theme "patient-doctor communication" splits into 3 sub-topics: "describing needs", "medical terminology problems", and "challenging the outcome". The above process has been

repeated 11 times, and no more new themes and topics have emerged in the last two interviews. At the end of this process, the interview schedule covers 8 broad themes with 44 sub-topics (Figure 5.2).

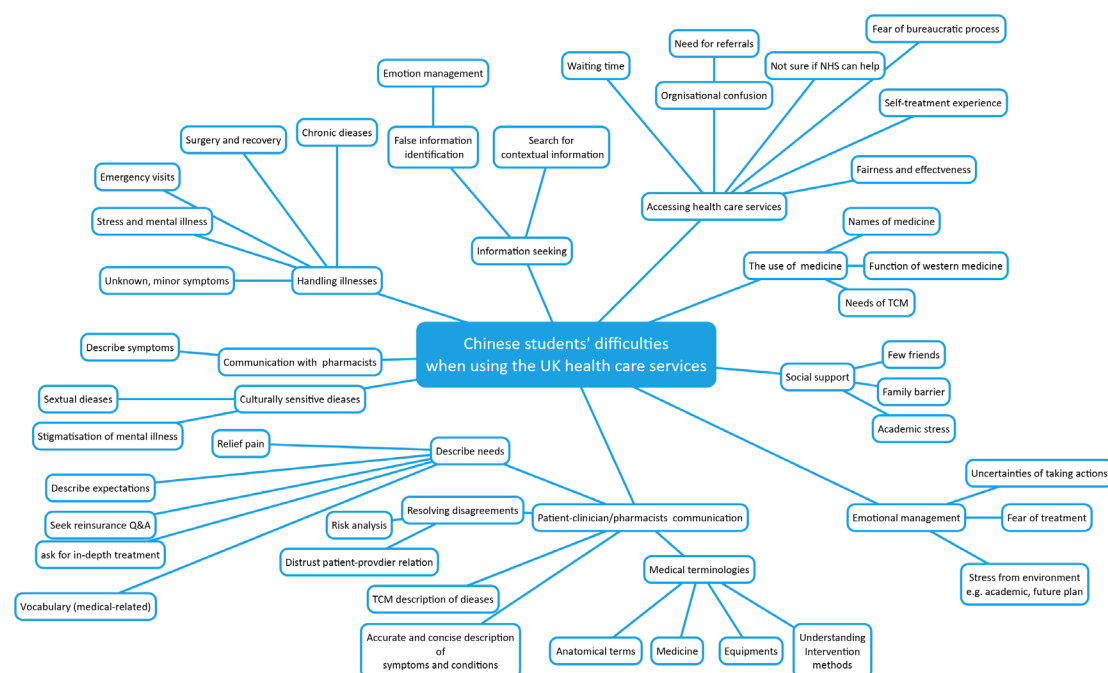


Figure 5.2 A mind map of interview topics emerged after the data reached saturation.

The study was approved by the School of Psychology Ethics Committee at the University of Edinburgh, Reference No. 273-1819/2 and sponsored by the Academic and Clinical Central Office for Research and Development (ACCORD) framework, a research partnership between the NHS Lothian Scotland and the University of Edinburgh.

## 5.2.2 Research context and participant recruitment

This study was conducted in 2019, before the COVID pandemic started. We recruited students from the University of Edinburgh. This is because the University of Edinburgh is a popular destination for Chinese overseas students to study. In 2022, the University of Edinburgh had a total of 49,065 students, of which 8,420 (17.1%) were Chinese overseas students. This is the largest group of overseas students at the University (*University Factsheet, 2022*). Of these, 42.3% are studying undergraduate degrees, 47.9% are studying postgraduate taught degrees, and 9.9% are studying research degrees. Since the University of Edinburgh is a Scottish University, University students should register and utilise Scotland's healthcare services. Although treatment methods are the same, the healthcare system in Scotland (NHS Scotland) differs somewhat from that in England (NHS England). The Scottish system is more publicly owned. The Scottish NHS focuses more on primary and community care. Pharmacy is

usually the first place of contact for common minor illnesses, rather than the General Practitioner (i.e., the Pharmacy First service). People do not have to pay for their prescriptions in Scotland. Additionally, the Scottish NHS also offers free social care services for people over 65 (*The Four Health Systems of the United Kingdom - The Health Foundation*, 2014).

Participants were selected using purposive sampling. People were welcome to participate in the study if they were or have been studying in UK higher education institutes for at least 6 months and have at least one healthcare management experience (in any form) during their period of study. These inclusion criteria ensure that the participant has some exposure to student life in the UK and has some healthcare experience in the UK to talk with. We recruited participants in three ways: advertising through the University's email lists, distributing leaflets around the University's campus area and posting via social media platforms (e.g., WeChat and Weibo). Participants were recruited voluntarily. No compelling words were used in recruitment posters.

All interviews took place in quiet and private spaces and were conducted in a one-to-one, face-to-face format. Before the start of the interview, participants were informed about the study's aim, method of data collection and how the data would be processed. They were also reminded that this study was completely voluntary, and they had the right to withdraw from the study whenever they wanted. Since talking about healthcare problems may elicit unpleasant experiences, participants were also told that they had the right to skip or refuse to discuss topics that could make them uncomfortable. Participants were asked to give consent before the start of each interview. They received a £10 Amazon voucher for compensation after the interview.

Interviews lasted around 90 minutes. To facilitate conversation, all interviews were conducted in Mandarin. At the start of the interview, participants were asked to describe one healthcare experience that they had during their time in the UK (e.g., "Could you tell me an experience that you have with the NHS?"), and then the interviewer would ask follow-up questions based on the participant's description (e.g., if the participant mentioned that they feel that the NHS is difficult to use, the interviewer would ask "How do you manage your health in China, and how does it differ from the UK?"). Most interview questions were open-ended. Data was collected in the form of audio recordings and hand-written notes, and stored on encrypted password-protected laptops. Interviews were transcribed verbatim. During the transcription process, sensitive information such as names and locations was removed from audio recordings and replaced by pseudonyms in transcriptions. Due to the availability of resources, these raw transcriptions were translated into English by using Microsoft Word's built-in translation function.

By the end of the study, we recruited 11 participants. The interviewees consist of 3 male and 8 female participants. 9 of them were master's students and 2 were PhD students at the time of participation. All interviewees were aged between 22 to 25 years old, with CEFR English proficiency ranging from B2 to C1 (i.e., all of them were able to communicate in English effectively in academic and daily contexts). Participants studied a wide range of subjects, including arts, science, engineering, law and education. All participants have stayed in the UK for at least a year, of which 5 participants have stayed in the UK for 3 years or above. All of them come from economically developed regions in the Northeast, Southeast and Southwest parts of China. Details of participants' demographic information are listed below (Table 5.1).

Table 5.1 Demographic information of all interviewees who participated in the grounded theory study.

| ID   | Age   | Study       | Degree level | English proficiency | Length of stay                       | Place of origin |
|------|-------|-------------|--------------|---------------------|--------------------------------------|-----------------|
| P1F  | 20-22 | Art         | Masters      | B2                  | 1 year                               | Guangdong       |
| P2F  | 20-22 | Education   | Masters      | B2                  | 1 year                               | Chongqing       |
| P3M  | 23-24 | Design      | PhD          | C1                  | 5 years                              | Shandong        |
| P4F  | 23-24 | Design      | Masters      | B2                  | 3 years                              | Jilin           |
| P5F  | 23-24 | Law         | Masters      | B2                  | 1 year                               | Zhejiang        |
| P6F  | 23-24 | Literature  | Masters      | C1                  | 1 year                               | Jiangsu         |
| P7F  | 23-24 | Informatics | Masters      | B2                  | 2 years                              | Jiangsu         |
| P8F  | 20-22 | Art         | Masters      | C1                  | 7 years                              | Guangdong       |
| P9M  | 25-26 | Informatics | PhD          | B2                  | 3 years                              | Henan           |
| P10F | 23-24 | Linguistics | Masters      | C1                  | 2 years                              | Shanghai        |
| P11M | 20-22 | Art         | Masters      | B2                  | 5 years<br>(including undergraduate) | Beijing         |

### 5.2.3 Data analysis

The formal data analysis took place after data had reached saturation (the “End” state in Figure 5.1). We imported all transcriptions and memos into the qualitative analysis software, NVivo (release 1.7, (*Best Qualitative Data Analysis Software for Researchers / NVivo*, 2023)) to facilitate qualitative coding. The formal analysis started with open coding (or called initial coding) and was then followed up by focused coding and axial coding. Table 5.2 shows an overview of the analysis process. The outcome of this study is a framework that explains how Chinese students utilise healthcare services.



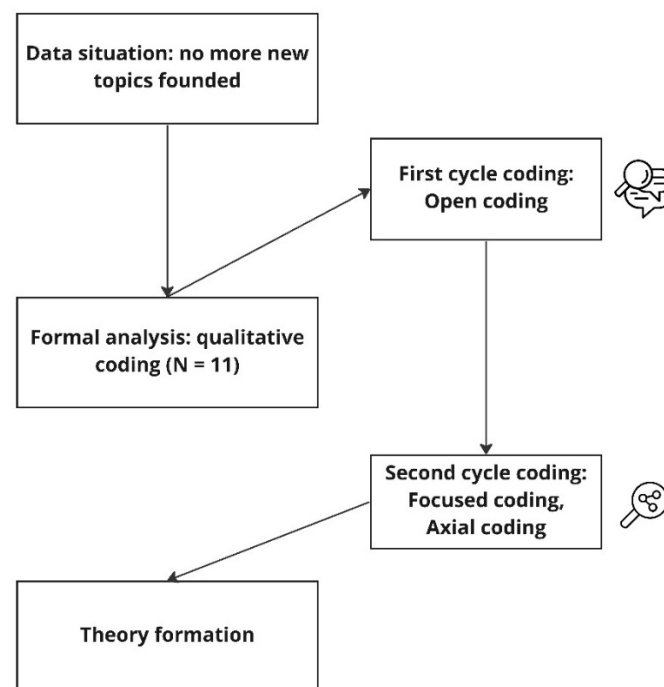


Figure 5.3 Formal data analysis: 2 cycles of the coding process.

Open coding is a first-cycle coding technique to break down large pieces of qualitative data into segments, while “remaining open to possible theoretical directions suggested by your interpretations of data” (Charmaz, 2006b; Saldaña, 2013). It is an inductive coding method, where codes are directly derived from data, not from other codes. Open coding does not tie to specific coding techniques and allows codes to overlap each other. The aim is to capture as many emergent topics as possible. In practice, we used a wide range of first-cycle coding techniques in Saldaña’s book (2013) for open coding, including descriptive, process, in vivo, versus, and emotion coding.

The open coding process was carried out by me and another British researcher concurrently. As we were investigating an intercultural context, having coders with Chinese and British backgrounds benefited us to gain a better understanding of the context. Both researchers have experience in qualitative analysis. Open coding is an iterative process. First, we go through one interview script line by line and highlight interesting excerpts. We generate new codes or apply existing codes to the excerpt. If it is a new code, its name and its description will be added to the codebook for later reference. If it is an existing code, we check if the code’s description makes sense to the transcript excerpt and if we want to make any changes. Any additions or changes to the codebook were discussed until agreements had been reached. At the end of each interview, we updated the codebook to reflect any changes being made. Then, we go back to transcripts which we had already coded and revise them to see if new codes or changed codes still make sense. Since we were using auto-translated

transcripts, coding concurrently helped us to correct translation errors and disambiguate meanings.

By the end of the interview, the up-to-date codebook consists of a total of 58 initial codes. 22 of them are at the higher level (i.e., at the summary and descriptive level), and 36 of them are at the lower level (i.e., at the detailed and specific level).

Table 5.2 provides an example of initial codes. The first column is the interview excerpts. The second column is their associated codes. The third column is the definition of codes. For example, ways that Chinese students interact with the UK care system repeatedly occur in interviews. We reference this type of topic by using the summary code “patient-provider interaction”. Within patient-provider interaction, Chinese students often have problems when interacting with doctors. We reference this as the summary code “Doctor-patient interaction”. One problem in the doctor-patient interaction is that they often feel under pressure during consultations because of the time. We reference this as a specific code “Short of time”. While talking to doctors, students may attempt to argue with the doctor’s advice; we reference this as a specific code “Challenging the outcome”. The reason we distinguish between summary codes and specific codes is to facilitate the organisation of the codebook. The summary codes are different from the focused codes, which we derived from the second-cycle coding process.

Table 5.2 A section of initial (open) codes with their definitions and excerpts.

| Interview excerpts (translated)                                                                                                                                                                  | Initial (open) codes            | Code definitions                                                                                                                |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| “He asked me what was wrong. I replied to him about the symptom together with my speculation and asked him if he could help. He then did a common examination”. (P02F, line 36)                  | Doctor-patient (DP) interaction | Things relate to or happen when the patient interacts with doctors.                                                             |
| “I was surprised that the consultation only lasts for 10 minutes. The time is so tight. If you have a minor problem, that’s fine, but what about more serious problems?” (P10F, line 174)        | Short of time                   | Not much time for consulting, and examination.                                                                                  |
| “I asked the doctor directly if I could do an ultrasound test or something, but the doctor was very determined that I did not need these.” (P5F, line 14)                                        | Challenging the outcome         | Thoughts and behaviours that challenge doctors’ diagnosis, or the desire for challenging it regardless of the actual behaviour. |
| “I asked him about the success rate of this operation, but he didn’t give me a definitive answer. I feel that it is my right as a patient to know about it.” ( Without knowing the success rate, | Making decisions                | Actions that relate to deciding whether to proceed with medical interventions or not.                                           |

|                                                                                                                                                                                                                                                                                           |                              |                                                                                                   |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|---------------------------------------------------------------------------------------------------|
| she found it hard to make informed decisions) (P07F, line 348)                                                                                                                                                                                                                            |                              |                                                                                                   |
| “When talking to doctors, I would try to avoid using medical terminologies. I would describe what happened to me. It is easier to just talk about a concrete event.” (P01F, line 417)                                                                                                     | Tactics for DP communication | The way that Chinese students or doctors resolve doctor-patient communication difficulties.       |
| “The dentist explained the process in great detail, like what are the possible treatments, what are the side effects of those treatments, how the treatment will be carried out, and how much each will cost. He also gives his recommendation based on the examination.” (P8F, line 262) | Fully Informed               | Health professionals give information that the patient wants to ask, therefore removing concerns. |

After open-coding 11 interviews, we went back to the codebook and started the second cycle of coding. Firstly, two coders carried out the focused coding. Focused coding is a technique where coders review all open codes to rename, restructure, and merge them based on their relations to research questions. The outcome of this technique is to generate categories that are meaningful to research questions and organise them in the form of a hierarchical structure (Saldaña, 2013). To do this, the same coders who did the open coding reviewed all the open codes with all of their interview excerpts to determine their relation to the 3 sub-research questions in [RQ1]. If both coders determine that a code and its excerpts are meaningful to the research questions, we then keep the code. If both coders feel that a code is somewhat linked to research questions, we then consider renaming it so that it can make more sense to the research questions. Otherwise, it will be merged into other codes or deleted. This process is done by using the Miro online collaboration platform and the NVivo software. We first copy all the codes into an empty canvas in the Miro board and then go through each code with its excerpts by using the NVivo query function. After that, we renamed and redefined these open codes and merged them into a hierarchical order in the Miro board.

For example, after reviewing all the excerpts from the open code “making decisions” (Table 5.2), we found that excerpts from this code reflect three aspects of meaning: the first is about the negotiation process between the patient and the doctor. This overlaps with the code “challenging the outcome”, where the student disagrees or is reluctant to agree to the doctor’s suggestions. Thus, we merged excerpts that contain this aspect of meaning to “challenge the outcome”. The second is about “making sense of the practice”, where the student has difficulties understanding medical practices during doctor-patient communications. This aspect of meaning was merged into a new focused code called “lack of common ground” in patient-doctor communication,

where lack of medical knowledge is a barrier preventing effective decision-making. The third is linked to emotion. When making decisions, students often complained about doctors' advice. This dissatisfaction comes from distrust, where the student may feel that the doctor may not have taken them seriously. We refer to this aspect of meaning as the "feeling of being undervalued". We removed the code "making decisions" as we split these meanings into other codes.

Another example is about removing the open code "fully informed". In interviews, we found that students often have a good experience with the doctor if the doctor is aware and able to answer students' concerns. Although it is a key technique for doctors to communicate with students successfully, it does not link to our main research question, i.e., how students themselves behave to dealing with health-related issues in the UK. Thus, we decided to remove this code from the focused coding.

We also made changes to reduce confusion. We have one open code, "Pragmatic difficulties", which is used to refer to difficulties that arise from real life, such as mobility problems and financial concerns. We also have another code called "pragmatic issues" which is used to refer to communication difficulties that arise from the consultation context, for example, the way to express disagreement about the doctor's advice. To distinguish this, we renamed the first code as "Practical issues" and then merged the second code with another code "Communication difficulties". By the end of focused coding, we generated a total of 4 top-level categories, i.e., "Perceived difficulties", "Individual and situational-specific factors", "Attitude towards Healthcare Services", and "Post-decision behaviours". Each of them represents one aspect of Chinese students' experience of utilising UK healthcare services. These 4 categories include 26 secondary-level categories, which further consist of a total of 202 detailed-level themes (i.e., these themes are affiliated with secondary-level categories) (see Appendix B3 for all of the detailed-level themes). The reason that we have far more detailed-level themes than the first cycle open codes is that, as we read through excerpts, we added details to make codes more meaningful to the research question. For example, for the open code "Tactics for DP communication", we split it into "Keep going to one doctor", "Describe conditions in a more serious way", "Being proactive" and "Planning ahead". These codes describe students' behaviours for better communication in a more concrete way.

After the process of focus coding, we obtained several hierarchical clusters. Next, the same two coders reviewed these categories for the third time to conduct the axial coding. This time, we focused on the relations between categories. For each top-level category, we discussed its characteristics or attributes, went through its secondary-level categories and examined them with other secondary-level categories' secondary-level categories. Due to the analysis complexity, we only go through the top-level categories and their secondary-level categories to specify the relation between categories (4 top and 26 secondary-level categories, not the 202 specific themes). The

goal is to see if and how top-level categories link to each other and whether these links answer the research question.

For example, there is a salient interconnection between all 4 top-level categories, which we referred to as the Demotivation loop for engaging with the healthcare services. Most students who just come to the UK may not be familiar with how UK healthcare services work, and have never engaged with the NHS before. Once they run into health issues, they may not know the right way to contact the NHS, e.g., they might be thinking of going to the hospital when having minor illnesses (“Organisational barrier” in the top-level code “Perceived difficulties”). They might ask their peers or read posts online to learn about how other people did. If they hear negative experiences, their attitudes will be reshaped, e.g., it takes a lot of time and effort, but would get nothing useful from the doctor (“Perceived effort vs perceived benefit” in the top-level code “Attitude towards Healthcare Services”). While students prefer to manage illnesses themselves (“Self-intervention” and “Use of medicine” in the top-level code “Post-decision behaviours”), this attitude spreads to the student community to demotivate others from utilising healthcare services.

The axial coding process highlights an important aspect of the reluctance of healthcare services utilisation. Apart from “Perceived difficulties”, “Direct motivation to use”, “Attitude towards Healthcare Services”, and “Post-decision behaviours”, the demotivation to utilise also arises from the influence of others. Students learn from online posts or other people’s healthcare experiences to shape their expectations of potential visits. If they heard about negative things from other people’s experiences (such as the NHS being inefficient), students would feel unworthy to visit the doctor and seek alternatives. Then, this negative impression spreads across the student community as people share more and more dissatisfaction. Since the influence of other people directly contributes to students’ motivation to visit, we decided to create a new top-level category called “Social influence”, and with its associated secondary-level categories: “Influence from family”, “Influence from peers”, and “Influence from online”.

In the axial coding process, we also removed unnecessary layers in the categorical hierarchy to reduce the complexity of the framework. We merged secondary-level categories that share common properties into one conclusive category. For example, the secondary categories “Positive impression towards the NHS” and “Negative impression towards the NHS” share the same dimension to describe the impression towards the NHS, so we merged them into “Impression towards the NHS”. For the secondary categories “Feelings of being valued” and “Feelings of not being valued”, we merged them into “Perception of values”. After the axial coding process, the framework has been simplified into five top-level categories (“Perceived difficulties to use”, “Attitudes towards healthcare services”, “Social influence”, “Direct motivation”, and “Post-decision behaviours”) with 19 secondary-level categories. The details of

each top-level category and its secondary-level categories are described in Section 5.3. The full framework of the Chinese students' healthcare services utilisation behaviour is described in the discussion section (Figure 5.4).

## 5.3 Results

### 5.3.1 Perceived difficulties

"Perceived difficulties" is one of the top-level categories that emerged during the data analysis. This category describes burdens and barriers that Chinese students think are difficult to overcome when engaging with healthcare services in the UK. This category aims to answer [RQ1.3]: "What kind of underlying difficulties prevent Chinese overseas students from using healthcare services in the UK?". We identified five types of perceived difficulties from the data, i.e., "Language and communication barrier", "Organisational disorientations", "Emotional and cognitive burdens", "Interpersonal barrier" and "Sociocultural matters". Table 5.3 represents the secondary-level categories with their associated detailed-level themes.

Table 5.3 Themes and sub-themes in the top category "Perceive difficulties to use"

| Top-level category            | Associated secondary-categories    | Detailed-level themes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-------------------------------|------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Perceived difficulties to use | Language and communication barrier | Language: <ul style="list-style-type: none"> <li>the linguistic problem</li> <li>understand medical terminologies</li> <li>use terminologies appropriately in medical contexts (linguistic pragmatics)</li> <li>understanding accents</li> </ul> Communication: <ul style="list-style-type: none"> <li>worried about articulating medical conditions</li> <li>short of time to interact with the doctor</li> <li>miscommunication leading to a superficial diagnosis</li> <li>lack of common ground for communication (do not understand medical knowledge)</li> <li>lack of skills to negotiate with doctors</li> </ul> |
|                               | Organisational disorientation      | <ul style="list-style-type: none"> <li>unfamiliar with healthcare services in the UK</li> <li>hard to make appointments with specialists</li> <li>hard to arrange multiple appointments</li> <li>hard to register with a GP</li> <li>sharing unpleasant experiences with friends, "Tucao"</li> </ul>                                                                                                                                                                                                                                                                                                                     |
|                               | Emotional and cognitive burdens    | Emotional: <ul style="list-style-type: none"> <li>fear of unknowns:               <ol style="list-style-type: none"> <li>worried about the side effects</li> <li>stick to known health care route</li> </ol> </li> </ul> Cognitive: <ul style="list-style-type: none"> <li>diminishing cognitive ability under urgent situations or emergencies</li> </ul>                                                                                                                                                                                                                                                               |
|                               | Interpersonal barriers             | <ul style="list-style-type: none"> <li>small social circle: few people available to seek help</li> <li>few social resources available, no access to social networking resources</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                               |
|                               | Sociocultural matters              | <ul style="list-style-type: none"> <li>hard to mapping TCM beliefs into Western medical practices</li> <li>differences in the positionalities between doctors and patients in China and the UK</li> <li>differences in living styles between China and the UK</li> <li>taboo and stigmatisation of certain types of illnesses</li> </ul>                                                                                                                                                                                                                                                                                 |

### 5.3.1.1 Language and Communication Barrier

“Language and communication barrier” is the type of barrier that many Chinese students have experienced or anticipate having by the time they speak to healthcare providers. This barrier contains two distinct but related barriers: the language barrier and the communication barrier.

Since Chinese students use a non-native language to talk about their illnesses, they will experience linguistic problems (i.e. language-related problems). Some Chinese students have to “think twice” when considering visiting healthcare services.

But at that time (when considering visiting the GP)... there was a feeling that... my English speaking skills were not that great. What happens if others cannot understand what I am saying? And what if I cannot

understand what other people are saying? ... Do you have the confidence to fully understand what the doctor is saying? Do you have the confidence to communicate with doctors in English? (P7, 514-519)

The most prevalent issue among interviewees is the difficulty in understanding and the use of medical terminology. Students may be confident to communicate in English in daily and academic contexts, but not in healthcare contexts.

I studied in an international high school, where all courses are taught in English. There's no problem for me to communicate in English. The only thing that I am worried about is that I don't understand medical terminology. (P8, 126)

This also applies to students who have lived in the UK for a long time. A student who lived in the UK for 5 continuous years describes his linguistic issues as "I have no issue describing where the pain is; however, I still have to prepare beforehand to learn terminologies about symptoms and diseases. (P3, 54)."

Sometimes, this problem goes beyond English itself. An interviewee thought that it is not only the English problem that makes it hard to communicate but also the understanding of medical concepts.

I always have one particular problem regarding language and communication in healthcare contexts. Sometimes, I cannot express myself in this situation, even in Chinese. Some feelings are very subtle. I mean, those concepts can only be understood directly, and it is hard to describe them verbally. You don't know these concepts in Chinese, how is it possible to describe them in English? (P6, 125)

Many interviewees struggled to describe illnesses using appropriate terminology. P5 had a hard time describing irregular period pain when talking to the GP. "It's hard to describe my condition, I want to describe TongJing (痛经- period pain in Chinese), but I was stuck at that moment, and described it as blood coming every month for females [laughter]. (P5, 54-56)". Even if students looked up the medical terminology in the dictionary, students may still feel uncertain. One interviewee stated that "there will be many terms with similar meanings when converting a term from Chinese to English, and there is only one term that conveys exactly what you meant. Other terms just have similar meanings in the broad sense (P9, 62)." P8 had difficulty describing the type and extent of tooth pain she had to the dentist (P8, 430). P3 is aware that this problem links to the pragmatic aspect of language, as he was not familiar with the "use of words" in the clinical context. "Some terminologies in Chinese cannot be translated literally into English. It just does not work like that". Another interviewee added that people never know if a term is appropriate before people actually use it.



You will have an awkward feeling when using another language to express your condition, especially when you have just looked it up. You don't know how to use that word (appropriately in the context). You don't know whether you used that word accurately, but (accurate description is crucial for the medical diagnosis). (P7, 286)

In addition, some students find it difficult to understand heavy accents. P10 found that nurses in Scotland have a strong Scottish accent. To understand when she would get the results from a blood test, she had to ask the nurse to repeat it several times (P10, 299). The medium of communication also affects students' ability to comprehend accents. P10 feels that the voice on the phone is slightly distorted compared to a face-to-face context (P10, 312). P11 found it would be harder for her to communicate with 111 or 999 than with the GP, as both sides can use body language. "More information can be conveyed face-to-face" (P5, 154). P10 added that if she had a hard time understanding things, the healthcare professional would be aware of this in a face-to-face setting. "When the nurse saw my confused face, she slowed down the voice and then wrote down all the instructions as a note for me to read" (P10, 301).

The other aspect of the category is about communication in medical contexts, i.e. the communication barrier. This includes non-linguistic problems that occur or are anticipated to occur during patient-doctor interaction.

Some interviewees described their concerns about articulating symptoms to doctors. Apart from the difficulty of using medical terminology, students are worried about the consequences of miscommunication.

When I first came to the UK, my speaking skills weren't that great. Sometimes, there were misunderstandings when I was talking with my UK friends. The talking is not smooth (I think they have to accommodate me). There might be problems and delays if this thing happens between the doctor and me.... I worried that I could not express (my feelings and symptoms) accurately. (P4, 204-206)

If it is a serious illness or it is an emergency, I won't be able to prepare (for what I want to say). Given that I am not familiar with medical-related terminology, I sometimes worry that the doctor will misunderstand what I am saying. Then, miscommunication leads to misunderstandings and a host of other consequences. (P9, 335)

P6 expressed her concern that she would run into problems even if she had prepared what to say beforehand. She thinks that the dynamic and real-time nature makes it hard to predict what will come up.

Although I have looked up the symptoms and use cases in English, sometimes there were new things popped up in my mind when I was

talking to the doctor. Then, you will not be able to express them easily as you haven't prepared for them. (P6, 113)

Students also feel that the consultation time is not enough. Many feel the pressure of time to describe their symptoms. "The GP consultation is only about 10 minutes, I cannot describe my problem in detail (P11, 5)." Another student concluded that all doctors in the UK are "in a rush" based on her care experience in the UK.

That is..., you have to explain (describe) one thing (illness) clearly to the doctor, and then the doctor will do some examinations on you and then give you advice. The entire process only lasts for 10 minutes. How is that possible? I feel that would be really rushed. You can do this in under 10 minutes for minor illnesses, but serious ones can be troublesome. (P10, 174)

The "short of time" often leads to superficial diagnoses. P6 experienced anxiety and hair loss and wishes to discuss the problem with the GP. She would like to fully describe her problem to know what was going on; however, she was interrupted by the doctor due to the time limit. The doctor stopped her and advised her to resolve one symptom at a time. The doctor advised her to go to the counselling service, leaving the hair loss problem unsolved (P6, 9, 271). After suffering wrist pain for a further 2 months after consulting the GP, the P9 reflected that he would give more details to the doctor so that the doctor might treat him more seriously.

That consultation was straightforward. I told the doctor that I was having wrist pain, and the doctor told me it would be fine. It will recover itself within a month. He just asked me to monitor it.... But at least I think what I had described at that time was too "mild". I did not attract enough attention from the doctor, as the wrist pain gradually got better after 2 months. (P9, 227, 235)

A major underlying reason for the communication difficulty is the lack of common understanding. According to Clark & Brennan (1991), having a common understanding is the foundation for effective communication. However, students may lack an understanding of medical knowledge when talking to doctors. Many interviewees stated that it is hard for them to make sense of medical concepts and practices. P3 mentioned that he did not understand the name, ingredients and effects when the doctor suggested which medicine to take (P3, 80). P5 shared the same feeling. "(When communicating with the GP) The most challenging bit is understanding medical terms. The doctor will explain these terminologies for sure, but you will still not be able to get what the doctor meant sometimes (P5, 152)".

What is the difficulty in communication? It was when I was having an injection, the doctor told me what was being injected (for internal

tissue repair). But there are many kinds of medicines the internal tissue repair. The medicines here may be different from those used in China, but I couldn't remember the name of the medicine used in China. (P10, 188)

Another aspect of the lack of mutual understanding is the lack of mutual assumptions. It is common in China, people can easily access some types of prescribed medicines without a doctor's approval. P6 was refused by the pharmacist when she wanted to buy sleeping pills at the pharmacy.

I was experiencing a lot of pressure at the end of the term. I would like to get some sleeping pills because everyone is rushing to finish writing papers. You know, you must ensure you are in a good (mental) state to write papers. Then, at that time, I felt that I was no longer able to write any papers. I couldn't write any more. I wanted to get some sleeping pills to have a good rest. I really wanted to have some sleeping pills. However, he (the pharmacist) refused to prescribe the pills. He told me I had to see a doctor first. (P6, 150)

In addition, P3 pointed out that differences in assumptions of medical practices between students and doctors may lead to potential conflicts.

I have heard from others that doctors here may be more cautious about using antibiotics. Like in China... because I have never taken drips (intravenous drip) for fevers, I have no such experience, but for some people in China, it is common to use intravenous drips (with antibiotics) for colds and fevers. If they want the same thing here, this will be a problem. (P3, 50)

P5 suffered from abnormal period pain for a long time, and she wished to have an ultrasound scan to know what was going on in her body. She assumed that this was straightforward, as people can access equipment-based examinations easily in hospitals in China. In China, almost all doctors rely heavily on the examination results to make treatment decisions. However, her request was refused by the doctor. She found it rather difficult to negotiate with the doctor and eventually gave up.

The doctor determined that... I did not need these examinations. He said that it would take a long time to wait for that, and I might not be able to do it by the time I return to China. Anyway, he listed some reasons that I don't need to do this test. (P5, 14)

I feel that I couldn't change his (doctor's) mind. Anyway, it is true that my communication skills are limited, and I don't want to have some unpleasant conflicts in the UK, including verbal conflicts. (P5, 314)

### 5.3.1.2 Organisational disorientation

“Organisational disorientation” is the type of difficulty that Chinese students have experienced or anticipate experiencing when approaching healthcare services in the UK. Since healthcare services in the UK are mainly residential and referral-based, students may not be familiar with the process of accessing healthcare services. In China, the primary care sector is still under development. People usually go to the hospital (to see a specialist) directly if they are ill. Unfamiliarity with UK services and difficulty in arranging healthcare service visits are the two main aspects of this barrier.

Many interviewees were not familiar with how the healthcare services work in the UK. Students may not know what to do or use the wrong service when they run into health problems. P2 called 999 after she accidentally cut her finger accidentally, but no one responded (the right way is to call 111). Then, she was planning to run to the hospital before a pedestrian guided her to the nearest medical centre (P2, 212). Similarly, P5 used the 999 every month to deal with her period pain, as she believed that she was in an emergency (P5, 16). P11 had symptoms of appendicitis, i.e. colic pain near the appendix. At first, he visited the GP for help (P11, 153). Some other interviewees know the way to use healthcare services to some extent, but often have some misconceptions. For example, P9 thought that people cannot change their GP once after registered (P9, 247). He was confused about the two NHS systems in England and Scotland, particularly about fees and payments.

I still don't know which ones (services) you have to pay for and which ones you don't. In what situations do you have to pay and in what situations don't you? Umm... if you get a prescription, do you have to pay for it yourself? (P9, 411)

Many interviewees are intimidated by the amount of time and work to put into arranging a healthcare visit. Many interviewees complained about the waiting time to see a doctor. P3 stated that “queuing... not only happens in big hospitals, you even have to wait in a long queue to see the GP, and this (is the thing that) I have complained most (P3, 249)”. P8 feels that she would avoid going to the GP if possible, as she heard that people need to wait for 2 to 3 weeks to be seen. P6 shares the same feeling and added that it is not worthwhile to visit the GP as she feels that the appointment booking process is troublesome. P10 feels that the university's mental health service visits are worthless, as you would recover during the time of waiting.

You can't just walk in to be seen. You have to wait for the appointment. I know a classmate of mine who had waited for 2-3 weeks after he booked the appointment and was still not being seen. He then tried to reach out to the University's GP, however, they still told him, “We will call you as soon as possible.” [laughter] I think they have relatively low

efficiency, as there are only 2 to 3 doctors in the GP. Hmm... Then I thought that, if I didn't need to go to the GP, then I would not go there. (P8, 378)

Doctors are relatively inefficient, and they can't see many patients a day, that's all. Then... I think the procedure of appointment booking is troublesome, so I basically don't go to the GP (for minor conditions). Except for (obtaining prescribed) medicines, and I don't go there for any other things. (P6, 238)

But to be honest, when I was under a lot of pressure during this period (end of term), I did not want to go see mental counselling, as I know that, until the holiday period, if you have psychological problems, you may not be able to be seen. (P10, 356)

Other interviewees have also complained about the effort to request and arrange for specialised care services. As mentioned previously, as for “communication difficulty”, P5 had a hard time persuading the doctor to approve an ultrasound test for her abnormal period pain (P5, 14). Similarly, P2 was first refused by the doctor to do an electrocardiogram (ECG) test as she was experiencing chest pain.

I asked the doctor if I could do an ECG test because I had strange chest pain. The pain is just...not like you have a headache and you can't eat or sleep well. That's normal. Chest pain is strange, so I was wondering if I could do an ECG test to see if there are any problems with my heart. I initiated the request as I know that here will allow you to waste medical resources. The doctor said I was fine. It was a mental health problem. He asked me to go to the counselling service instead, but I still felt chest pain, so I asked if I could have an ECG test, because, for heart problems, you can't make a proper diagnosis with a stethoscope. (P2, 66-70)

P7 had an unpleasant experience regarding the effort to arrange appointments with specialists. She has a hypertrophic scar called a keloid, which needs specialised injections periodically. When she was in China, she just needed to go to the hospital periodically to have the injection. The problem will be resolved within 2 hours (P7, 67, 69). However, the treatment process is rather complex in the UK. First, she has to book and visit the GP for preliminary screening, and then the doctor puts her on the waiting list for the specialist's further examination. She waited for a month to be seen (P7, 101). After the first injection, she had to book another appointment for the next injection. However, she missed it once as she was back in China. When she returned to the UK, she had to go back to the GP to ask for an injection appointment (P7, 216).

Once students have unpleasant experiences, they would “TuCao”, which stands for the action that people sharing bad experiences with others. As the GP refused P5 to carry out the ultrasound testing for her abnormal period pain, she shared her experience with her peers. This affects other people’s decisions when considering healthcare service utilisation (this is related to the influence of peers).

I said that I went to the GP, and I had a very unpleasant experience. Of course, I did “TuCao” with my friends. It was purposeless; I just got a bad feeling and wanted to share it to feel better. [laughter] (P5, 403)

Why would I visit the dentist? Many colleagues around me said that booking appointments is rather troublesome. It sounds complicated, so I did not go. (P4, 128)

Some interviewees did not even register with a GP, despite that the University has asked them to do so. P4 and P8 have lived in the UK for many years but did not register with the GP. P4 attributed her reluctant behaviour to the “laziness part in my personality” (P4, 130). She was not aware of the importance of registering with a GP.

I think that because there were many things to do when I just arrived in the UK. I put it aside first, and then I forget about it for about two months. In fact, I had taken the GP registration form when I went to this student centre, but I just left it there. I didn't really register. Procrastination. Because I think I have to do the more important and urgent things first, and the GP registration may not be so important. (P4, 132)

Apart from laziness, P8 stated that she did not register with a GP as it is hard to find GPs who accept new patients. She came to the UK after the semester had started. She had asked many GPs but was still out of luck (P8, 310). Then, her motivation to register faded away as she had nothing urgent to see doctors (P8, 316).

### 5.3.1.3 Emotional and cognitive burdens

“Emotional and cognitive burdens” are a type of barrier that relates to the psychological aspects of Chinese students. We identified two types of burdens that trouble Chinese students for using healthcare services: the emotional burden and the cognitive burden.

The emotional burden refers to the feeling of reluctance. Students may not want to seek professional help because they emotionally do not want to, particularly because of the fear of the unknown. P7 describes this fear as the denial of knowing something bad.

I am a person who does not want to go to the hospital unless it is absolutely necessary, because I am afraid that something terrible will be found out, and then...and...so I don't like to do regular physical examinations. (For the skin problem) I don't worry about that too much because I already know what it is, I just need to get continued treatment here, but I really don't want to go to the hospital. It's like psychological trauma. (P7, 501)

P4 pointed out another fear of the unknown, the fear of side effects of unknown health practices. She refuses to go to the dentist despite she was experiencing occasional toothache occasionally.

I know it is painful, just kind of... but it is not happening all the time. It does not affect my life, so I feel like I don't need to deal with it. There are also uncertainties if you ask the dentist to pull it out, such as inflammation or something like it. (P4, 128)

Some interviewees prefer to stick to healthcare practices that they know about, i.e., Chinese healthcare services, over experiencing something that they are not familiar with, i.e., healthcare services in the UK. For example, P10 was planning to check her teeth once she returns to China as she feels that "I have been using this dentist since I was a child, I feel more at ease (P10, 12)." P9 prefers to use certain medicines that he brought from China over buying medicine in the UK. "I stick with this medicine not because it is TCM. I don't think the TCM is more effective, but I have taken this medicine in the past and it really works (P9, 387)".

The cognitive burden refers to the diminishing of cognitive ability. This usually happens when a student needs immediate treatment. P5 called 999 for her severe period pain. However, she found it rather difficult to communicate with the person on the other end as she had to bear the pain, trying to recall past residential information and describe her condition in English at the same time.

999 asked me a series of long, long questions, which I couldn't even react to these questions at that point. My entire body was very painful, and I had to answer questions that I couldn't remember. I had just moved to a new place, and the phone handler was asking about my previous address, which I had completely forgot. He also asked me how I felt, etc. However, I was even unable to make up my voice at that point. It was a difficult time communicating with her. (P5, 6)

P2 cut her finger accidentally and was bleeding when she arrived in the UK for a few days. Her mind was completely "blank" and she did not know what to do.

This was quite serious. The finger was bleeding heavily and could not be stopped (by a bandage). I had just arrived in the UK, so my mind was

blank. I couldn't understand what other people were saying and they were unable to understand what I was saying. In addition, I hadn't registered with a GP at that time and I didn't know where the hospital is.

#### 5.3.1.4 Interpersonal barriers

"Interpersonal barrier" is a type of barrier that Chinese students have experienced or anticipate due to the lack of social or interpersonal resources in the UK. Small social circles and few social resources available are the two main aspects that contribute to this barrier.

Chinese students commonly come to study in the UK alone. This means they have to meet new people and try to establish a social circle in an unfamiliar environment. Making friends and establishing a supportive social network requires time. A social network is simply not available when Chinese students first arrive in the UK. This makes it rather hard to seek help from others when they are ill. For example, P2 cuts her finger and cannot stop the bleeding. She planned to run outside from the dormitory and grab a pedestrian to ask about the nearest hospital (P2, 214). She would be in a better state if she knew someone could help in an emergency. Similarly, P5 had a difficult time when she was experiencing abnormal period pain.

It started with vomiting and diarrhoea, and then... I didn't have the strength to speak or move. I didn't know what to do, that is... I didn't know anyone to ask for help. (My first reaction was to find the resident assistant), but the resident assistant lived on the same floor, but he was not there. I eventually called 999 myself. (P5, 32)

Apart from emergencies, some students may feel reluctant to ask peers for help. P11 has lived in the UK for many years but never asked others for help as he is a "mature adult". It will "trouble" others if asking for help.

No. I think it feels strange to talk about it with others. Besides, if can go to the doctor if you have health issues. We are all adults, is this necessary (to ask someone else for help)? ... From my perspective, it's impossible for me to ask others for help. I never ask others. I always go see doctors myself, so I suspect that others may also be similar. (P11, 278)

Some interviewees added that they have no close friends here for help. P1 never asked people around her for help when she was experiencing anxiety. She did not disclose her problem to others due to the lack of close friends in the UK.



Of course, I would like to disclose this problem to my close friends (to see if they can come up with any ideas to deal with it). However, because of the time difference, or the distance, I feel it may be useless... it may take a few hours to receive a reply. But if you talk about your problem with people around you, who are not close friends, you might just trouble them. They don't have the obligation to listen to you talk about these things.... Besides, they won't be able to understand your situation, and even feel that you are "JiaoQing" (i.e., too sensitive). (P1, 407, 409)

P4 had a hard time dealing with suspected symptoms of bipolar disorder. She eventually overcomes herself. She had thought about going for a psychological consultation, but she never thought about seeking advice from friends.

I have thought about looking for other people to help. At that time, I wanted to see a psychiatrist or something. Friends... No. Because I was very "quiet", I didn't have any close friends to talk to, so I used my "work" to express my feelings. (P4, 244)

Chinese students may also have few social resources. Social resources are items that can be used to exchange or facilitate exchange in society, such as money, goods, information and social status (Foa & Foa, 2012). Chinese rarely have opportunities to know and exchange "hidden" local information, such as which GP is faster and which doctor is more responsible. P3 pointed out that Chinese students may be at a disadvantage in accessing UK healthcare services when comparing the differences between China and the UK.

From the perspective of Chinese students, you can "ZhaoRen" (find someone so that you have a personal connection to doctors). So, you can... you can book an appointment easily with a domain expert if you have the connection. Here... You don't know whether the GP that you have registered have a high-quality standard or not. The UK may have a higher overall quality, perhaps, but you don't know the quality of individual doctors. (P3, 50)

#### 5.3.1.5 Sociocultural matters

"Sociocultural matters" is a type of barrier that includes social and cultural factors that affect Chinese students' motivation to use UK healthcare services. We identified 4 kinds of social and cultural factors that may affect Chinese students' healthcare service utilisation. They are the influence of Traditional Chinese Medicine (TCM) (P3, 244), the

positionality between doctors and patients, differences in people's living styles between China and the UK, and the taboo and stigmatisation of certain illnesses.

In China, people commonly use TCM concepts to describe discomfort. In TCM, illness is caused by the imbalance between "Yin" and "Yang". Many symptoms can be regarded as "Leng (cold)", i.e. too much "Yin" or "Re (hot)", i.e. too much "Yang". People need to keep the balance between "Yin" and "Yang" in their bodies to stay healthy. The goal of TCM practices is to help the body keep this balance and facilitate the body to healing by itself.

Doctors in China can recognise these concepts and use either TCM practices, Western practices, or a mix of the two to handle the problem. However, UK doctors cannot recognise these TCM concepts. This makes the articulation of symptoms and medical needs rather difficult. Doctors in the UK simply do not understand what the "Yin" symptoms are and what the "Yang" symptoms are, and they would not use TCM practices to deal with the problem. Differences in this culturally related health beliefs often lead to misunderstandings and culture shocks. P8 described her hard time explaining that she had a common TCM symptom, "ShangHuo (on fire, a symptom caused by too much Yang)" to the doctor.

I remember once I was attempting to explain that I had a ShangHuo to the doctor, but then I was aware that he would not understand XiangHuo. You can only talk about symptoms that were physically present, that is, what the condition is (in the Western medical sense). Chinese people know XiangHuo relates to what you eat (eating habits, e.g. eating too much spicy food) or what you do (getting angry). This might confuse the doctor here, as they would have a different understanding (e.g., they may wonder what these things have to do with medicine). (P8, 176)

P3 have a friend who runs into culture shocks and medical troubles, as her description of a high fever confused the doctor. She was expecting to have some "warm (hot)" TCM medical practices. However, the doctor gave her a "cold" physical medical practice.

I know a girl who was heavily dependent on taking drips every time she caught a severe cold (high fever) in China. This time, she caught a cold in the UK, and she wanted the doctor to give her drips, the same as what doctors did in China. The doctor here refused her request. She then told the doctor that she needed to "cool down" because she had a persistent fever. She wanted to express that she needed to take drips to lower the temperature, but the doctor turned on an electric fan to "cool" her down (physically). She felt shocked by the doctor's practice as she felt cold in her inner body. (In TCM terms, cold is a "Yin" symptom and physical cooling is another "Yin" medical practice. You never face a

fan to deal with a cold). She “TuCao” (complained to) me about her terrible experience by the time she came back from the doctor.

The difference in the positionality between doctors and patients between China and the UK is another factor that leads to misdiagnosis and delays in treatments. In China, doctors are seen to be professionals and the authority. If a person has a health problem, the doctor will run a range of tests to determine what is going on, and then give advice and intervention mainly based on the test results. However, in the UK, since the first contact point is the GP, they rarely use physical tests but rely more on patients’ descriptions. They give advice and intervention mainly based on the patient’s descriptions of symptoms and needs. However, Chinese students may not be aware of this difference, and they believe that doctors would “handle it”, regardless of their articulation of symptoms and needs. Their descriptions may confuse the doctor and, as a result, several interviewees have visited the GP multiple times to solve the same issue.

P5 was experiencing abnormal period pain. However, she described the symptom as “stomach and abdomen pain” during her first visit, with little emphasis on the fact that she had just had her period a day ago. This misleads the doctor to think that she had a digestive problem. Thus, she felt that the doctor was not treating her seriously (P5, 168). P9 was experiencing suspicious symptoms of tenosynovitis, i.e., swelling tendon sheath. However, he did not disclose his concern to the doctor, and the doctor did nothing about his wrist.

I did not tell the doctor that I think I have tenosynovitis. Because I was also not sure about that, and I trust the doctor to figure it out.... I don’t know if I described it well last time, but I feel like my description may be “too mild”. At least it didn’t attract enough doctors’ attention. The doctor told me that that feeling would go away completely within a month, but it only got a bit better after 2 months. (P9, 213, 235)

Chinese students may have unique living habits, which may be a barrier for them to conduct healthcare practices in the UK. For example, Chinese people have different eating habits compared to ordinary UK habits. They eat more glucose-containing food than protein-containing food such as rice, noodles and porridge. P10 have a difficult time getting insightful diagnoses from the NHS website, as one of the questions asked about her daily nutrition intake. She was having an excessive sugar intake compared to ordinary people in the UK (P10, 295). P8 had acute appendicitis, and while she was in the period of recovery, she could not adapt to food in the UK. She wanted to have some porridge, as porridge is commonly perceived as an easy-to-digest food in China.

After my father came over to the UK (to look after me), he cooked for me. He bought a rice cooker and took it with him. Because I was in an

urgent condition, so I lived in a single ward. He bought the rice cooker and cooked rice porridge for me. (P8, 154)

The difference in living styles also affects medical practices in mental health. Some interviewees pointed out that mental health counsellors are not useful as they lack an understanding of the sociocultural context of Chinese students. P2 feels that the advice given by mental health counsellors is ineffective. She was experiencing anxiety when trying to finish multiple coursework. She went to the counsellor and the counsellor told her that she was experiencing too much stress, which she already knew. Then, the counsellor advised her to attend a course, but she did not even have time to do so (P2, 116).

P1 was experiencing some interpersonal issues, and she pointed out that the UK counsellors may not be able to understand some psychological activities and behaviours.

For psychological problems, I think some behaviours are treated to be "abnormal" from a Chinese perspective. Maybe he (the counsellor) is a foreigner...he will think these behaviours are normal. I think this has to do with cultural differences. Everyone's views on this matter will be different. (P1, 463)

The last sociocultural issue relates to the perception of illness from a society's point of view. People in China often see certain illnesses and medical practices as taboo, and they may want to avoid them if possible. For example, people often dismiss their mental health conditions. This also applies to Chinese students. They rarely seek professional help as they think their condition is not "severe enough".

I don't think it is serious enough to look for a psychologist. But I know that I felt rather anxious when writing the thesis. By the time I felt that the whole world was about to collapse, the first thing that I could think of was to contact my close friends and family in China. Then... Then I just cry in the room alone, just on my own. I never thought about going to see a psychologist, but if someone who knows me could have a chat with me, I would really appreciate it. (P5, 566)

Sex-related problems and practices are another taboo in the Chinese community. People in China may be rather sensitive in treating these problems. P5 had a bias toward the use of contraceptive medicines. She worried about their side effects, and she refused the doctor's suggestion to take contraceptive medicines in the long term to deal with her abnormal period pain.

He also gave me another suggestion at that time, that is... that is, he told me that I could take long-term contraceptive pills. He told me that I can take contraceptive pills continuously for a year so that I only have

4 periods a year. This feels horrible. I don't accept this kind of advice.... He added that I can stop taking contraceptive medicines when I get married. He asked me when I plan to get married and when I plan to have children... all these sensitive topics. He told me that there would be no impact if I stopped using them 2 years before having children, but I still thought this practice was risky, so I refused him. (P5, 320, 322)

### 5.3.2 Attitude towards UK healthcare services

“Attitudes towards UK healthcare services” is another top-level category that emerged during the data analysis. This category describes Chinese overseas students’ impressions, attitudes and feelings that they hold towards the NHS, as well as their internal decision-making process for healthcare service utilisation. This category aims to answer [RQ1.2]: “What are the attitudes that Chinese overseas students hold towards UK healthcare services?”. We identified 4 distinct aspects which relate to Chinese students’ attitudes, thoughts, and feelings towards UK healthcare services, i.e. “Impression towards the NHS”, “Time, effort and benefit evaluation”, “Personal belief”, and “Perception of values”. Table 5.4 represents the secondary-level categories with their associated detailed-level themes.

Table 5.4 Themes and sub-themes in the top category “Attitudes towards UK healthcare services”

| Top-level category                      | Associated secondary-categories     | Detailed-level themes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-----------------------------------------|-------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Attitude towards UK healthcare services | Impression towards the NHS          | Positive: <ul style="list-style-type: none"> <li>• fair, free, polite, integrated</li> <li>• alternative treatments available</li> </ul> Negative: <ul style="list-style-type: none"> <li>• slow, effort-consuming, ineffective</li> <li>• unprofessional</li> </ul>                                                                                                                                                                                                                                            |
|                                         | Time, effort and benefit evaluation | Perceived time & efforts: <ul style="list-style-type: none"> <li>• a lot of preparations have to be done before the visit</li> <li>• a lot of time and effort for booking appointments</li> <li>• time to receive the service is long</li> </ul> Limited benefits: <ul style="list-style-type: none"> <li>• perceived to be useless</li> <li>• difficult to obtain prescribed medicines</li> <li>• ineffective mental health intervention</li> </ul> Prefer self-intervention over visiting healthcare services |
|                                         | Personal beliefs                    | Mismatched expectations due to experiences in China<br>Service misuse due to unfamiliarity: <ul style="list-style-type: none"> <li>• unfamiliar with ordinary, urgent and emergency services</li> </ul> Higher expectations: <ul style="list-style-type: none"> <li>• Minimum and conservative intervention</li> <li>• Expect to have specialised services in GP</li> </ul>                                                                                                                                     |
|                                         | Perception of values                | Being valued feelings: <ul style="list-style-type: none"> <li>• informative and being empathetic</li> </ul> Not being valued feelings: <ul style="list-style-type: none"> <li>• doctor being dismissive</li> <li>• not being informative for making decisions</li> <li>• doctor being unprofessional: neglective and inconsistent</li> </ul>                                                                                                                                                                    |

### 5.3.2.1 Impression towards the NHS

“Impression towards the NHS” describes Chinese students' general perceptions of the NHS. Interviewees expressed mixed feelings towards the NHS, with some positive points such as treatment equality, but mostly negative points, emphasising the fact that the NHS is ineffective and inefficient.

On the good side, interviewees appreciate that the NHS offer fair treatment and treats patients equally. P3 feels that healthcare services in the UK have a wider population coverage. “It allows people from different social classes to have the same opportunity to benefit from the medical service (P3, 48).” P11 feels that the NHS is “conservative”, but it will treat you properly if you absolutely need “advanced” medical service.

I feel that the NHS is conservative. What I mean is... they will not carry out surgery (and examinations) if you don't absolutely need to. In China, it is common for doctors to ask patients to carry out examinations using intricate machines. These costs are high, and hospitals can make profits from patients. The NHS... they have to consider if you really need this

thing after all. If you need this thing, they will give you these (surgery and examinations) without hesitation. (P11, 221)

P10 praised the NHS for being informative. She liked the NHS's website, where she can look up symptoms and what to do about them (P10, 54). P7 liked that the NHS staff were always polite and informative.

(When I was doing the CT scan) Staff were very polite. They give instructions clearly and politely, like "telling you which part to take, where to change clothes, and whether it is okay if you do this or that". They care about you. In China, staff are more imperative, like "take off your pants, or sit here" I think it is more polite here. (P7, 176)

On the bad side, interviewees have complained about the NHS being slow, effort-consuming and sometimes unprofessional. After appreciating NHS's fair treatment approach, P3 pointed out that this could also be a drawback from an individual's point of view. "If you have a high fever, you will have to wait for a long time to be seen. The system in the UK, to make the service accessible, they are lowering its efficiency. This also affects Chinese students. (P3, 52)". P7 talked through her "waiting" experience to receive "proper" treatments for her keloid symptom.

In China, I can just go to the hospital, register (same-day appointment) with a doctor, get the injection, and receive the medicine within 2 hours. But here is far more complicated. I have to book an appointment with the GP, yes, you have to book first. Usually, the appointment will not be on the same day, for example, I booked on Monday, but I won't be able to see the doctor until Wednesday.... At the GP, since I knew what I needed, then I told the doctor clearly that I needed the injection and the ointment (medicine for keloid). GP told me that they didn't have the ointment. For injection, they had to book another appointment, which I would be notified of by letter within a month. The waiting time was rather long. (P7, 69)

Some interviewees have a strong feeling that the healthcare services are unprofessional. P8 had a bad experience when she was asked for a blood draw from her arm. She concluded that she didn't expect them to do much after a few unsuccessful attempts by the doctor. "Maybe my blood vessel was hard to find. The doctor tried to pierce my arm 3 times, but still, no blood came out (P8, 336)." "I don't have a high expectation for them to handle illnesses unless it is an operation, that kind of thing (P8, 338)." P6 had confusing experiences with pharmacists, where one pharmacist agreed to sell her a certain type of eye drop, but another one did not do so. She still does not know why, as the only thing that changed is the pharmacist (even at the same pharmacy), making her feel that pharmacists are unprofessional here.

The first time was rather simple. I asked the pharmacist if they had any kind of eye drops that deal with red eyes or a special kind of inflammation. Not the normal type, though. He said yes, and he explained to me how to use it and told me that this eye drop had some anti-inflammatory ingredients in it. I told him that was fine. Then he told me that if the condition does not improve, come to us, and we can find other suitable ones for you. Then that's done. However, I don't know why for the second time.... The other pharmacists insisted that my condition was not serious. I just have red and dry eyes. He told me that I just needed to rest more. (P6, 324, 318)

### 5.3.2.2 Time, effort and benefit evaluation

"Time, effort and benefit evaluation" documents interviewees' thoughts and arguments for or against visiting UK healthcare services. When deciding whether to go for a healthcare visit or not, Chinese students need to think about the amount of work that they need to put in and the potential returns they will get. Many interviewees tend to "self-intervene" over seeking professional help (e.g., P3 and P9) because they have to put in a huge amount of time and effort, but receive limited benefits from visiting healthcare services.

Many interviewees feel that they need to spend a lot of time and effort on a healthcare visit. For example, P4 stated that if she visited the doctor, she would look up a range of illness-related vocabulary to ensure that the doctor could understand what she was saying (P4 118). P7 added that she would also look up her "feeling" of the illness in English beforehand, such as "tingling sensation," the feeling of being pricked by a needle, to articulate symptoms (P7, 69).

P3 described how he would prepare for a healthcare visit in detail. First, he would start by making sense of it. He may have a rough idea of what kind of symptoms they are. He would look up possible causes and illnesses online based on the symptoms. Then, he would search again about these potential illnesses, and study them, particularly about ways to describe them if he thought it was relevant to him. Next, he would highlight the vocabulary that he did not know, and use Google Translate to translate them into English. After that, he would search for these vocabularies in English and read through different web pages to double-check if these words are still relevant to his symptoms. He would never go to see doctors without these preparations to ensure accurate communication (P3, 230-240).

For potential benefits, many interviewees feel that they would receive limited help from the NHS. Many complained that the visiting health professionals were not useful.



P5 regularly called 111 every time she had an abnormal period, but she gradually felt that 111 and the GP could not provide “substantial help (P5, 124)”. “(The 111 will redirect me to the GP) They did not ask me anything specific. For GP visits, they told me period is just like that. I feel like they only record it and do nothing (P5, 132)”. P7 told the GP clearly about the injection and medicine she needed, but the GP simply told her they didn’t have that machine (P7, 69). P8 was experiencing occasional toothache, and she did not see the dentist as she assumed that they would “not help much”.

First, it is not to the degree that I cannot bear. Second, I felt that it was not necessary. It is the same as the appendices problem that I had. They would do nothing if you looked “normal”. (For the toothache) is not the pain to the degree that I absolutely need to fix it.... I feel like it is unnecessary to trouble them. If they cannot make much difference, and while I can deal with it, why do I trouble them? (P8, 394, 398)

The “limited help” is also reflected by the difficulty in obtaining prescribed medicines. In China, people can access prescribed medicines in pharmacies. However, in the UK, people need to be examined by doctors before taking prescribed medicines. P9 brought some anti-inflammatory medicines (anti-biotics) before he arrived in the UK (P9, 359). P3 mentioned he was asked by his friends many times if he had any spare anti-inflammatory medicines (P3, 154). Those who do not have any “stock” and are “unable” to source from others will have a difficult time persuading the GP.

I found a very different point is that... regardless of how you dealt with the illness in the past, the doctor would only prescribe you the medicine that you know you are going to need unless he thinks you absolutely need it. And he will give you in a very conservative way. If he doesn’t believe you have the problem, he will not prescribe any medicine. For example, my nail fell off once, and there was a blood clot in it. The clot broke the nail, and the nail was a little bit red and felt swollen. My mother suggested me to see a doctor as she worried that there was an infection going on. Then, the doctor told me that there was nothing wrong. I asked the doctor if I needed to take some medicine, but he said no need at all and chased me away. (P6, 8)

Some interviewees also feel that mental health counselling is particularly ineffective. As described in Section 5.3.1.5, P1 would speak to a close friend rather than a professional counsellor to deal with interpersonal problems (P1, 463). P2 thinks that the counsellor’s advice is too unrealistic for her to implement (P2, 116). While considering visiting mental health counsellors, P4 stated that “the counsellor is just there to listen. They probably can’t do much to help me out (P4, 252)”.

### 5.3.2.3 Personal beliefs

“Personal beliefs” describe Chinese students’ health beliefs when considering visiting healthcare services. Different from the health beliefs in the Health Belief Model (Janz & Becker, 1984), which describes the perception and the action of an individual to handle illnesses, we define “personal belief” as students’ expectations of what UK healthcare services can do. This subcategory records interviewees’ expectations of what healthcare services in the UK can do, and what the healthcare services can actually do. From interviews, we noticed that students often hold this “mismatched expectation” that leads to dissatisfaction and conflicts.

Students may hold wrong expectations because of their prior healthcare experience in China. They often take for granted that healthcare services here will function in the same way as it is in China. For example, you would be treated quite quickly if you visit the emergency department. However, P3 mentioned that his friends were rather surprised by the time he visited the emergency department in the UK. He was having severe bleeding from his hand. He had waited for about an hour and a half, and he felt surprised by the time he saw others with even more severe conditions were still queuing in front of him (P3, 248).

For another example, in the UK, there are 2 emergency hotlines, 999 and 111. The first one deals with immediate life-threatening problems, and the second deals with urgent but non-life-threatening problems. In China, there was only one emergency hotline, 120, which dealt with both problems. P5 was “educated” by the GP, as she called 999 every time she was experiencing severe period pain. This made her a bit unhappy as she felt that she was indeed in an emergency.

The doctor told me that you knew you would not die, so why did you call 999? He looks angry and emotional. He said if an old lady is living next door to you, and she suddenly has a heart attack, but at this time, 999 receives a call from you and comes to save you instead of her. The old lady might be in danger.... I told him that I called 999... three times, just three times. But what makes me unhappy is that, given my situation (so painful), I didn’t know if I was about to die or not. (P5, 383, 387)

Interviewees also criticised that doctors are “too conservative”. P11 has a friend who broke his bone; his friend consulted both doctors in China and the UK, who advised him on very different treatment plans.

I have a classmate who broke his bone while skating. It is a typical example of a bone fracture. The doctor described his case as a “perfect example” of a bone fracture. My classmate felt rather bad at that time. He took his film (CT film) and asked doctors back in China. The doctor

in China suggested that to use internal fixation, i.e., implant screws if possible and then rest for several months. However, doctors in the UK only used plaster fixation (external fixation) and asked him to rest for only weeks. I felt like the treatment here is rather “conservative”. (P11, 11)

Students often overestimate what the doctor can offer, especially when going to the doctor for physical examinations as they want to know what is going on with their bodies. P5 had severe period pain again and again and strongly felt that the GP’s advice of taking painkillers is “ZhiBiaoBuZhiBen” which stands for “relief symptoms, but not cure the disease”. On her third visit, she strongly hopes to do some physical examinations as she wants to know what is wrong with her body (P5, 286). However, her request was denied by the doctor as the doctor thought she would wait for a long time (P5, 320). Similarly, P2 was experiencing symptoms of chest pain. She wanted to do an ECG test to see what was going on, but the doctor refused her as her blood pressure and heartbeats were normal. The doctor concluded it was a mental health problem and advised her to take ibuprofen (P2, 28-42).

#### 5.3.2.4 Perception of Values

“Perception of values” refers to feelings of satisfaction or dissatisfaction when Chinese students visit healthcare services, particularly concerning service quality. Some interviewees expressed their appreciation to the healthcare professionals for being friendly, informative and empathetic. Other interviewees expressed their dissatisfaction with healthcare professionals being dismissive, non-informative, and unprofessional.

As shown in Section 5.3.2.1, P7 feels the staff are friendly and polite. She liked that the staff always politely gave clear instructions, rather than imperative commands (P7, 176). P10 feels that doctors and nurses are “informative” and “empathetic”. She fell to the ground and hurt her leg badly. The doctor prescribed her some “cream” that she had never used before. The doctor reassured her by explaining the purpose of having the cream after he saw her concerned face. Then, the nurse gave her clear instructions about wound cleaning and the way to use the cream (P10, 209). P6 reflected that healthcare services in China are more “procedural”. “For example, if you have this problem, they ask you to do physical examinations first, then check the results, and then prescribe the medicine. That’s it (P6, 265).” While P8 felt that the services here are more “personalised” after she had a good experience with a private dentist. She was surprised as they had a receptionist who could speak Chinese, and she could ask whatever questions she had in Chinese.

A lot of things are more convenient if they (the dentist) speak Chinese. For example, um... things just popped up in your mind. You can ask them directly in Chinese without further thinking, like, how much time will it take to receive this treatment? If you have any questions, you can tell your problem to the receptionist in Chinese, and they will report it to the doctor. I asked them to give me a lot of braces at once since the dentist is in London and I live far away, and they forwarded my request to the doctor. (P8, 277)

On the bad side, interviewees have complained that doctors are being dismissive and neglecting their needs. As mentioned in Section 5.3.2.3, P2 was experiencing symptoms of chest pain. She wanted to do an ECG test but was initially refused by the doctor. P5 had severe period pain and would like to do examinations but was refused by the GP (P5, 286). On her third GP visit, she also thought about going to a private doctor, but the GP told her she would be refused by the private doctor as well.

The GP doctor refused to do any examinations, but I strongly want to have a check. So, I asked him if I could see a private doctor. I will pay for it myself, to see if I can have a check through the private route.... He searched online and recommended several doctors, but, at last, he told me that even if I visited them, the result would be the same (no examinations would be carried out). (P5, 333, 339)

One interviewee was dissatisfied with the doctor being non-informative. P7 suffered from a chronic symptom, a keloid. When she presented to the specialist, the specialist asked whether she wanted an operation. The doctor explained the operation procedure in detail. However, the doctor did not give her a direct answer about the success rate of the operation.

I asked him what the success rate of the operation is, but he didn't give me a definitive answer. He just told me that the operation would be effective in dealing with keloid, and he did not want failure to happen. I feel like he was irresponsible because the patient should have had the right to know this kind of information before making the decision. For example, if you have an incurable illness and the doctor tells you that a new medicine is very effective, but you don't know the data, despite knowing it is effective. Then, people may ask, to what extent is it effective? I feel like this is my right to know all, but he did not tell me about it (the success rate), so I feel that he was irresponsible. Another thing is that this thing (keloid) has a high recurrence rate. (P7, 348-362)

Some interviewees feel that being undervalued as health professionals is unprofessional. As mentioned in Section 5.3.1.1, P6 experienced anxiety and hair loss and she wished to discuss the problem with the GP, but the GP interrupted her and

asked her to focus on dealing with one symptom at a time (P6, 9, 271). In Section 5.3.2.1, P6 complained about pharmacists giving inconsistent advice. She went to the same pharmacy and presented with the same symptom. One pharmacist agreed to sell her the eye drop that she wanted, but another pharmacist refused to do so. This makes her feel that pharmacists here are unprofessional (P6, 324).

### 5.3.3 Social Influence

“Social influence” is the third top-level category that emerged during the data analysis. This category describes the influence of other people, beyond Chinese overseas students themselves, on their health management behaviour in the UK. Although this category does not answer any of the sub-research questions directly, this category describes an important factor that influences Chinese students’ health management behaviour in the UK, which links to the main research question (RQ1) that we want to answer. This category describes some aspects of students’ health management behaviour [RQ1.1] and is a source of the influence on students’ attitudes towards healthcare services in the UK [RQ1.2]. We identified 4 aspects of social influence which affect Chinese students’ health management behaviour, i.e., “Influences from family”, “Influences from peers”, “Influences from online”, and “Influences from social environments”. Table 5.5 below represents the secondary-level categories with their associated detailed-level themes.

Table 5.5 Themes and sub-themes in the top category “Social Influence”

| Top-level category | Associated secondary-categories     | Detailed-level themes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|--------------------|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Social influence   | Influences from family              | <ul style="list-style-type: none"> <li>the encouragement received from family</li> <li>reluctant to disclose to family members</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|                    | Influences from peers               | <ul style="list-style-type: none"> <li>seeking confirmation of the condition from peers</li> </ul> <p>Sharing and learning from others' experiences</p> <ul style="list-style-type: none"> <li>in the form of small chats</li> <li>learn how other people did to familiarise themselves with the treatment process</li> <li>learn from other people's conditions to make sense of their own condition</li> </ul> <p>Tucao - sharing unpleasant experiences</p> <ul style="list-style-type: none"> <li>appointment booking is troublesome</li> <li>long waiting time</li> </ul> |
|                    | Influences from online              | <ul style="list-style-type: none"> <li>using online tools to make sense of medical concepts and practices</li> <li>using online tools to self-assess and seek reassurance</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                           |
|                    | Influences from social environments | <p>School and university:</p> <ul style="list-style-type: none"> <li>the school's policy on having health problems</li> <li>no or not aware of the school's policy</li> </ul> <p>Social media environment:</p> <ul style="list-style-type: none"> <li>opinions on social media about healthcare services in the UK or Western countries in general</li> </ul>                                                                                                                                                                                                                  |

### 5.3.3.1 Influences from family

“Influences from family” describes the influence of a student’s family members when the student is considering visiting healthcare services. Sometimes, students gain extra motivation to visit healthcare services due to the advice given by their family members. However, sometimes, students are reluctant to disclose their health issues to family members.

Students’ family members often encourage students to go to see a doctor if they are ill. Some interviewees would consult their parents when they are ill, as they felt that parents are more “experienced” (P1, 211). P1 was experiencing a continuous cough. She coughs heavily during the night. The cough persisted for over half a month despite she trying to take several TCMs, which she and her colleagues brought from China. She felt a bit worried, but she did not expect that the GP would be helpful, as this problem was so “minor”. However, her mother advised her to see the doctor, and she followed her advice anyway.

... (The cough persisted) Then I started to feel a bit worried, thinking that it had already been half a month and still had not recovered. I thought it would get better on its own. My mother said that it would be better if I went to see a doctor and see what they could do for me. Then

I came (to the campus) and made an appointment last week.... I knew that the doctor would probably not prescribe me any medicine because the symptoms were so minor, but my mother said that it was better to have a go. (P1, 82, 201)

Similarly, P5 was experiencing severe period pain. A part of her motivation to have a physical examination came from her mother, as her mother wanted her to have a physical examination to understand what was going on (P5, 304). As mentioned in Section 5.3.2.2, P6's mother advised her to see the doctor as her toenail fell off and there was a blood clot in it. Her mother worried that her toenail might have an inflammation (P6, 8).

While family members may encourage the student to seek professional help, some students are reluctant to disclose health issues to family members. P8 said that she just "did not have this thought" when she was having suspicious symptoms of appendicitis. In the end, the school contacted her parents about the issue instead (P8, 150). P11 was having "blood poo", a suspicious symptom of a haemorrhoid. He was prepared to have the surgery but did not say anything about it to his parents (P11, 61). P5 mentioned that she would not disclose her problems to her parents when talking about mental health issues, as she does not want to let them worry.

As for parents, I don't feel like they are a good source of help [laughter]. Because they will be very anxious. Once they know my problem, they cannot do anything there (back in China). Instead, by the time I am listening to their anxious voices, I feel even worse. (P5, 576)

### 5.3.3.2 Influence from Peers

"Influences from peers" describes the influence of people around the student when they consider visiting healthcare services. Students may ask peers for validation of the symptom and then plan things accordingly. Students may also share their anecdotes about their healthcare experiences and learn from each other, regardless of whether the experience is good or bad.

If a student is not sure whether their condition is severe enough to see a doctor, they may consult their peers for advice. For example, P3 did not know what to do when she first experienced abnormal period pain. She did not know if she could call 999 despite having severe pain. Thus, she found the resident assistant (RA) to seek validation.

Because I didn't know what to do, [laughter], and RA just lived on the same floor, but he wasn't there at the time. (I found him eventually)

Then, he felt that I was in danger, so he recommended I call 999. (P5, 32)

P4 had an inflammation after ear piercing. She was planning to ignore it, but was encouraged by her teacher from the pre-session course to go to the pharmacy for help.

I was in the class, and then I told the teacher, I said that I had an ear piercing, but then it became inflamed. The teacher was very nice, he told me that I should go seek professional help because an ear infection is a serious thing. It might be a small problem at first, but it would cause bigger problems. Thus, I went to the pharmacy to buy medicine.... Initially, I thought that I could make it through [laughter] because I'm healthy and robust. I thought that I could get rid of it as I have a strong immune system. (P4, 162, 166)

Apart from asking for advice, interviewees often share their healthcare experiences, regardless of whether it is pleasant or not. This usually happens during small talks. P4 described that this topic comes up naturally in small talk.

She (her friend) went to the GP as she had a sore throat. We were walking together, and she told me that she had gone to the doctor. (How did you get into this topic?) It was just casual talk; it happened naturally. Then, I followed up on the topic and asked her some more details, such as "What is it like?", and "Is it hard?" I was thinking that it would be a useful piece of information to know if I am sick too. (P4, 32-40)

Same as P4, other interviewees use this opportunity to exchange information. Some interviewees ask others about the treatment procedure that others have experienced to understand the process of the treatment. For example, P7 was planning to have the HPV jab in the UK and then she asked her friends about the procedure for applying for the HPV vaccine.

I learn this procedure from my friend. This process is... first... second... and then.... After they confirm the appointment time, they will send an SMS to your phone. If you want to change the time, you have to phone them. (How did you know all of this?) I asked my friend if she had had the HPV jab. She said yes. Then, I asked her how to do so, like how to book an appointment. I asked her this because, at that time, she was talking to another girl that she was going to have the second HPV shot tomorrow. So, I joined her conversation and asked her how to book the appointment. (P7, 30-42)



Other interviewees ask others about illnesses that others have experienced to make sense of the illness. P9 was having swelling wrist and worried that it could be Tenosynovitis (a kind of inflammation). He asked one of his friends who had been diagnosed with Tenosynovitis.

I asked him about his condition, such as under what circumstances it hurts, and how painful it is. Although (after asking him) it is still difficult to know the degree of the pain exactly, I had a rough idea about it.... (Why do you want to ask a friend?) Because my friend was confirmed with Tenosynovitis. It is a good source of reference. The information on the Internet may not be usable (informative), and sometimes too technical. (P9, 137, 141)

While interviewees exchange healthcare experiences through small talks, they also share their unpleasant experiences with other people to “feel better”, i.e. “TuCao” (this was also mentioned in Section 5.3.1.2). P5 shared her unpleasant GP visiting experience with her close friends as she was being refused by the GP to do any examinations and being “educated” by the GP about calling 999 frequently.

Like the last GP visit... I had some “ToCao” (I shared this unpleasant experience with others). It is not like sharing experiences with my friends, nor is it anything informative. I just had some idea or emotion (anger and resentment), and then I just told them about my emotions; there was no other purpose. (How would that be useful?) I feel like it is a psychological comfort (as you speak it out). As I just said, it is a feeling that you are suffering pain, whether you suffer it alone or there’s someone with you. The feeling is different. (P5, 403-409)

When people share or “TuCao” their unpleasant experiences, the listener would develop a bad impression towards the service. For example, after hearing about her friend's experience with the dentist, P4 decided not to go there despite she was experiencing a wisdom tooth problem. She felt that the appointment booking procedure was rather troublesome. She plans to fix the problem once she is back in China (P4, 128). P3 concluded that all healthcare services are “slow” as he has heard numerous “TuCao” from different people complaining about the waiting time for receiving treatments (P3, 244).

### 5.3.3.3 Influence from online

“Influence from online” describes the influence of online materials on Chinese students when they consider visiting healthcare services. When students experience

health issues, they may search for information online to make sense of the illness as well as to familiarise themselves with the treatment procedure in the UK.

P10 had a pimple breakout when she arrived in the UK. Although she used to have pimples, this time they formed red dots. She tried to understand this symptom by searching it online and found that it may be caused by an allergy. She was told to take the prescribed medication, and thus, she went to the GP for help (P5, 26-32). P9 spend time reading online posts of other people's experiences to understand the treatment process.

Reading online materials can shape one's expectations of the treatment. P9 found that his wrist was a bit painful. Then he searched online about "wrist pain" and learned about different kinds of "wrist pain" and their potential causes. By linking back to his situation, he understood that he was suspicious of Tenosynovitis. From there, he read further and formed an expectation that it is not a serious disease, but it is a chronic illness which needs long-term intervention. People need to contact their GP to start the treatment (P9, 145, 147, 151).

Some interviewees search for information online to seek reassurance. P8 searched online about the side effects of the HPV vaccine and its potential outcomes, as she had a swollen arm after the jab. After reading through the NHS website, she learned that what she was experiencing was just a minor side effect of the vaccine. Thus, she did not go to the GP.

I had an HPV jab. Some people don't have any problems after the jab. However, my arm felt painful for a long time, so I googled online to look up what the side effects of the HPV vaccine. The website (NHS website) told me that it is swelling, and it is normal. You should go to the GP unless you have a severe swelling. Mine is okay, it just lasted for a long time, so I did not go to see the doctor. (P8, 404, 406)

#### **5.3.3.4 Influence from Social Environments**

"Influence from social environments" describes the influence of the community and society on Chinese students when they consider visiting healthcare services. A supportive environment will encourage students to seek professional help and vice versa. In the interviews, students pointed out that the university plays a key role in creating such an environment.

P11 stated that the policy of his university would “back him up” if he ran into health issues. He would be confident to attend health services without worrying about schoolwork.

I will prioritise my health over schoolwork because health is the most important thing after all. Besides, from the attitude of the school here, whether you have physical or psychological discomfort, they would encourage you to seek professional help. I feel that the school's mechanism for attending health services is quite complete.... Because the mechanism is supportive, what I said is that the school respects you. You can apply for an extension from the school as long as you have a letter from the doctor. They would support you to achieve the best results without the influence of health issues. I can feel that I am being supported. (P11, 49, 55)

However, Chinese students may not feel like staying in a supportive environment. This is because either the university did not have policies as they have in P11's case, or they did not emphasise their policy so that students may not be aware of it. For example, as mentioned in Section 5.3.1.5, P2 she was experiencing anxiety when trying to finish multiple coursework. She went to the counsellor and the counsellor told her that she was experiencing too much stress, which she already knew. Then, the counsellor advised her to attend a course, but she thought that she did not even have time to do so (P2, 116). Similarly, P4 said that she would prioritise “other important things in her life” rather than registering with a GP (P4, 132).

In addition to the university, the social media environment, i.e., popular public opinions on social media, may also affect students' intention to use healthcare services in the UK, i.e., impression towards UK healthcare services.

(If it is a minor problem) I feel that it is unnecessary to bother them (UK healthcare services) if they cannot make much of an improvement (to let her have effective treatments). Why bother them if I can handle it myself? Besides, it's going to take a lot of time from me. A lot of time. (So you just bear it on your own?) Yes [laughter], this (impression) might be related to the fact that I have heard so much negative news about medical treatment in foreign countries (from the media). (P8, 400)

#### **5.3.4 Direct motivation to use (or not use)**

“Direct motivation to use” is the fourth top-level category that emerged during the data analysis. This category describes the direct motivations that Chinese students visit or do not visit healthcare services in the UK. We identified 3 types of motivations: the

nature of the illness, personal traits and self-awareness, and practical reasons. While students' perceived difficulties, attitudes, and social influence are the three hidden contributors to the motivation for healthcare service utilisation in the background, the three direct motivations are Chinese students' apparent reasons to visit or not healthcare services in the UK. This category partially answers Research Question 1.1, "How do Chinese overseas students manage their health in the UK?", which complements the first category, "Perceived difficulties to use" and the last category "Post-decision Behaviour". This category also partially answers the main Research Question 1, "How do they decide to use healthcare services in the UK?". Table 5.6 represents the secondary-level categories with their associated detailed-level themes.

Table 5.6 Themes and sub-themes in the top category "Motivation to use or not use"

| Top-level category           | Associated secondary-categories | Detailed-level themes                                                                                                                                                                                                                 |
|------------------------------|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Motivation to use or not use | Nature of the illness           | Severity of the illness: <ul style="list-style-type: none"> <li>• emergency conditions</li> <li>• unknown, minor, but annoying problem</li> <li>• chronic problems - specific medicines or treatments</li> </ul>                      |
|                              | Personal traits                 | Personal traits: <ul style="list-style-type: none"> <li>• laziness and inertia</li> </ul> Self-positioning: <ul style="list-style-type: none"> <li>• "sojourner" thinking (self-positioning, perceived to be treated less)</li> </ul> |
|                              | Practical reasons               | <ul style="list-style-type: none"> <li>• financial concerns</li> <li>• school workloads</li> <li>• mobility</li> </ul>                                                                                                                |

#### 5.3.4.1 The severity of the illness

The first motivation for Chinese students to visit healthcare services or not is dependent on the severity of the illness. If the condition is beyond the student's control, then they will seek professional help. For example, under an emergency condition, such as P2. She cut her finger and was bleeding heavily. She was unable to stop it; thus, she rushed out of the dormitory and ran to the nearest hospital (P2, 214). Other than emergencies, students may attempt to deal with the problem by themselves first. One common way is to go to the pharmacy to buy medicine. As mentioned by P8, if she had a common symptom such as a stomachache or headache, she would go to the pharmacy and grab the medicine from the shelf, without even consulting the pharmacist.

I think that I wouldn't bother the pharmacist if I could deal with it myself. If I have a headache or a stomachache, I will buy medicine directly. I will not ask the pharmacist. If I have a symptom that I don't know or the medicine I brought did not work, then I would ask him. Humm... I think common pharmacists are not very useful. For example, my friend had eye pain, she asked the pharmacist about which medicine to take. The pharmacist just asked some superficial questions and recommended the eye drops. However, the doctor told her that she didn't need to take this at all. (P8, 372)

For minor symptoms that students are not familiar with or have not experienced before, they may consider going to the doctor to ask for reassurance. For example, P8's friend, who was suffering from eye pain, went to the doctor eventually and wanted to know what was going on (P8, 372). P4 was experiencing symptoms of bipolar disorder at the end of the first semester, and she had thought about going to a psychological counsellor to seek "professional advice" (P4, 258). P11 had an unusual sore pain in his thumb and left foot, and given that some of his family members have rheumatoid arthritis, he went to see the doctor to see if he also had that problem (inherent disease) (P11, 249). P6 had excessive mental stress at the start of her first semester in the UK, which she described as "having some stress as a lot of insignificant things piled up", she felt panic and went to the GP in the end.

(Why do you go to the GP?) Because I think I lost my hair heavily, and I can't stop it at all. I was worried that I would become bald. I was worried that I might get something incurable. Thus, I went to the doctor. (P6, 63)

Some interviewees go to see doctors because they want to obtain a specific medicine or treatment. This usually happens to students with chronic problems. They have already been diagnosed elsewhere, and they want to continue their treatment in the UK. For example, P10 have long-term migraine headaches. She was taking the medicine, which she brought from the United States (she had been diagnosed with migraine headaches there initially). She went to the GP to seek help as she was running out of that medicine.

I have a long-term migraine headache. I was taking the medicine which I brought from the United States, but now it is running out. I came to the GP to ask the doctor if I should continue with it.... I brought the medicine from the States because I was examined and diagnosed there. I just went there and told the doctor about my symptoms and the cause (previous diagnosis).... I had a clear idea this time of what my needs are. It was all about medicine. I came to the GP to ask whether I should continue with it one, or change to something new. (P10, 279, 287, 288, 289)

#### 5.3.4.2 Personal traits and self-positioning

The second motivation for Chinese students to visit healthcare services or not is related to personal traits and self-positioning. This motivation varies by individual. P11 prioritise health overall, kind of things. “I will prioritise my health over schoolwork because health is the most important thing after all (P11, 49).” “(When I first came to the UK, everything is new for me, so I seek their (GP’s) help frequently even if I had a minor problem (P11, 9).” However, P4 have a completely different personality. She lived in the UK for three years but did not register with the GP as she thinks that the process is “troublesome”. She confessed that it was all about her “laziness” (P4, 12). Her “laziness” makes her feel reluctant to get in touch with UK healthcare services.

(From what I heard from my friends) Booking an appointment is troublesome, and I am a “lazy” type of person. I don’t want to plan things unlikely to happen. (P4, 128)

You have been talking about “troublesome”, you felt that communicating with the doctor is troublesome, and registering with a GP is troublesome. When you have wisdom tooth inflammation, you just borrow medicine from your friends. How do you define “troublesome” in your case?

It is like a kind of “inertia” (adhere to the known). It is a “laziness” which lives inside of me. (P4, 129, 130)

Furthermore, P4 believes that she knows best about herself. She believes that she can manage herself in most cases. While she made this claim, she was not aware of the importance of registering with the GP, as the GP is the “entrance” to any professional help. As a result, she did not take the GP registration seriously. She positioned herself as a “sojourner”, as she stayed in the UK only to complete her studies, so the GP could not help her much.

I was always sick when I was in China. As time goes, I learned about my health condition very well, like “JiuBingChengYi” (i.e., you become a doctor when you are sick frequently). And I also think that I can adjust myself to stay healthy. Thus, I feel that I don’t have to visit the doctor unless absolutely necessary. (P4, 64)

Aiya... actually, I did not care about registering with the GP. I didn't pay much attention to it. But if I want to stay in the UK and continue working, then I might register with a GP because I'll be here for a longer time. (P4, 134, 136)

### 5.3.4.3 Practical reasons

The third motivation for Chinese students to visit healthcare services or not is related to practical reasons. Practical reasons are reasons that relate to students' own situations and contexts when they consider visiting healthcare services. We identified 3 types of practical reasons, i.e., financial reasons, academic-work reasons, and mobility reasons.

Students will consider their financial state when making healthcare decisions. For example, P10 mentioned that she planned to see the dentist back in China once she submitted her dissertation. This is because she has insurance in China and dentists are relatively cheap in China (P10, 12). P3 have a friend who was injured after being drunk. He called the taxi instead of the ambulance as he thought that the ambulance was expensive (he thought that people had to pay for the ambulance in the UK, as it is in China) (P3, 26). P5 was initially planning to go to see a private doctor for examinations because she was being refused by the GP to do so. However, she changed her mind in the end due to the cost of the visit.

I initially wanted him (the GP) to refer me to a private hospital, so that I could pay for the check-up. But he said that if I wanted to go to a private hospital, I would have to enter another system and make another separate appointment with a private doctor, and then the private doctor would also have to decide whether or not I needed an examination. (He told me that) The cost would be high from start to finish, so I felt that it was not necessary. (P5, 14)

Some students will consider the school workload before visiting the doctor. If they were experiencing a heavy workload, they may prioritise schoolwork over going to the doctor. For example, P8 has had a toothache but still has not booked a dentist appointment yet.

(Are there any other considerations apart from the wait time? Because the earlier you make the appointment, the earlier you will be seen.) Yes, because visiting the dentist is a hassle. I also have coursework to do and deadlines to meet. If I book the appointment with the dentist now, I would still be seen after the deadline. So, I feel like it doesn't make much of a difference whether I go or not, maybe it will get better on its own later. (P8, 381, 382)

Another practical factor is the physical distance between the health service and where the student lives. P7 complained that the appointment she made (for the specialist examination) was far away from where she lives. She felt it was ironic when the GP

told her that the appointment was arranged based on where she lives. In the end, she went to the hospital, but with unpleasantness.

When I received that letter, they told me that I needed to wait for another 4 weeks, with the time and the place. First, the time was assigned to me, and second, the place was far away. It is near the [Address information], next to a shopping village. That is a place where I have to take the bus for one and a half hours to get there. It is very ironic as they (the GP) told me that the hospital is assigned based on where you live.

However, for P11, it is a different story. He lived near the medical centre. Thus, he went to the medical centre frequently when he had minor problems.

(Why do you go to the medical centre, given that it is a small problem?)  
Because it's very convenient for me. I live only a minute's walk from the medical centre. So I was thinking that, since I already paid for medical insurance in the UK, I might take advantage of using it. (P11, 27)

### 5.3.5 Post-decision Behaviours

“Post-decision Behaviours” is the last top-level category that emerged during the data analysis. This category describes Chinese students’ common health management behaviours during their time in the UK. We identified 3 types of typical health management behaviours: alternative management behaviours other than visiting healthcare services, demanding preparation behaviours for healthcare service utilisation, and students’ tactics to overcome difficulties during healthcare service utilisation. This category answers Research Question 1.1, i.e., “How do Chinese overseas students manage their health? What things do they do when they suffer health problems?” Table 5.7 represents the secondary-level categories with their associated detailed-level themes.

Table 5.7 Themes and sub-themes in the top category “Post-decision Behaviour”



| Top-level category      | Associated secondary-categories                       | Detailed-level themes                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-------------------------|-------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Post-decision behaviour | Alternative health management behaviour               | Simply ignore: <ul style="list-style-type: none"> <li>• ignore first, use drugs next, go to the GP last</li> </ul> Use medicine to self-intervene: <ul style="list-style-type: none"> <li>• purchase medicines</li> <li>• prefer to use TCM medicines</li> <li>• sharing TCM medicines</li> </ul> For mental health: <ul style="list-style-type: none"> <li>• ineffective professional help</li> <li>• prefer peer counselling</li> </ul>                                       |
|                         | Demanding preparations                                | Information searching and sense-making <ul style="list-style-type: none"> <li>• understand conditions</li> <li>• learn English terms</li> <li>• Chinese and English search behaviours</li> <li>• dealing with misinformation</li> </ul> Emotional demanding <ul style="list-style-type: none"> <li>• dealing with uncertainty</li> </ul>                                                                                                                                        |
|                         | Tactics to overcome difficulties of healthcare visits | Accessing to care: <ul style="list-style-type: none"> <li>• describe conditions in a more serious way</li> </ul> Interacting with doctors: <ul style="list-style-type: none"> <li>• keep proactive - ask questions if don't understand</li> <li>• be clear about the wants</li> </ul> Familiarise with the treatment process: <ul style="list-style-type: none"> <li>• Planning ahead</li> <li>• Learn from other's experiences - know what to expect and what to do</li> </ul> |

#### 5.3.5.1 Alternative Management Behaviours

“Alternative management behaviours” are behaviours that Chinese students use other than seeking professional help. This includes simply ignoring the symptom, using medicines to relieve and asking for others (non-professionals for help).

If the symptom does not cause a lot of trouble, some interviewees would simply ignore the symptom. As mentioned in Sections 5.3.1.3 and 5.3.4.2, P4 would ignore the symptom first if it is not serious (P4, 64). She simply ignored her periodic toothache (P4, 128). P8 ignored her toothache as she had low expectations of the NHS. “I don’t have a high expectation for them to handle illnesses unless it is an operation, that kind of thing (P8, 338)”.

First, it is not to the degree that I cannot bear. Second, I felt that it was not necessary. It is the same as the appendices problem. They would do nothing if you looked “normal”. (For the toothache) is not the pain to the degree that I absolutely need to fix it.... I feel like it is unnecessary

to trouble them. If they cannot make much difference and while I can deal with it, why do I trouble them? (P8, 394, 398)

Apart from simply ignoring the symptoms, some interviewees would use medicines to relieve their problems. Students would go to pharmacies to buy painkillers. For example, P8 said that if she has common symptoms such as a stomachache or headache, she would go to the pharmacy and simply grab the medicine from the shelf. She would not ask the pharmacist for help as she thought that they were not particularly “helpful” (P8, 372). Instead of buying Western medicines (from the pharmacy), other interviewees may prefer to use TCM (Chinese domestic medicines), and they bring a lot of TCMs from China as a “precautionary act”.

I brought a lot of medicine, for pretty much all symptoms, from cold and fever to diarrhoea, and to toothache, I even brought some eye drops. I bought a lot because I am afraid of being sick. During my undergraduate degree in China, I was sick quite often, and I'm afraid of getting sick frequently here. I brought a lot of medicine because I am used to taking these medicines, and I think I wouldn't be able to adapt to foreign medicines. (P6, 269, 371)

As described by P6, students may prefer to use medicines that they “know well”. P8 added that “pharmacists here will not recommend TCMs and I am not familiarised with Western Medicine (WM) (P8, 473)”. P9 feels that the TCMs are effective because he has tried them before and they always worked. “It is hard to say which one is more effective, TCM or WM, but for TCM that I have had, they work on me (P9, 386).”

The second reason that students prefer to use TCM is that some symptoms can only be described in TCM terms, which cannot be addressed by Western medicine. For example, P6 mentioned the concept of “QingHuo”, which stands for “extinguishing fire in your inner body”. “QingHuo” medicine would deal with the symptom of “ShangHuo”, which means “you have too much fire in your body”.

I brought some medicine from China, such as “VC YinQiao”, which I use to “QingHuo” (clear your internal fire). The concept of “QingHuo” doesn't exist here. They (people in the UK) just do not use this concept. I am afraid that I may “ShangHuo” (have too much fire) so I brought some “VC YinQiao”. (P6, 379)

The third reason that students prefer to use TCM is that they may not be familiar with the drugs in the UK. P6 said, “I am not familiar with the medicines in the UK. My understanding of medicines here is completely limited (P6, 388).” P3 has a friend who was experiencing a stomachache. Since she did not know which medicine was effective, she asked P3 if he knew any medicines to take, as he had lived in the UK for many years (P3, 174).

If a student does not bring or runs out of TCM medicine. They may borrow TCM from their peers. For example, P4 often borrow medicines from her close friends.

Ah... I borrow medicines from others because I forgot to bring medicines with me (from China). I just asked them directly for the medicine, and then they gave me some of it. I asked them on WeChat. I told them that my wisdom tooth was hurting (and if anyone could help with it), and then one of my classmates sent some medicine to me. Yeah, that's it. (A classmate?) Yes, a very good friend. (P4, 90, 92)

Students may go to the GP as their last resort if the “simply ignoring” and the “use medicine” strategies do not work. For example, P10 had a skin allergy (rash) but she did not go to see the GP at first.

I thought the symptom would get better by itself, but it didn't. Then I tried to control my habits for around 2 days by not smoking and drinking, and going to bed earlier, but it still didn't go away, so I went to the doctor in the end. (P10, 94)

As mentioned in Sections 5.3.1.5 and 5.3.2.2, Chinese students often feel that mental health services are ineffective. If they run into mental health issues, they would prefer to seek help from peers. P1 would speak to a close friend rather than a professional counsellor to deal with interpersonal problems (P1, 463). P5 stated, “No, I have never considered seeing a psychological doctor, but I would be very willing to have a chat if there's someone who knows you best (P5, 568)”. P4 has a close friend to talk about psychological issues, and they support each other throughout their student years.

(For psychological issues) We talked about our own past experiences and how we made decisions. Then... we agree with each other's choices. The main thing is to listen to each other first. We listened to each other, and then...as friends, I told her that I would support her in what she did. I think she is a kind person, so I think I will support her regardless of her choice. I just support her, mainly verbally. I also had a lot of resonance during the chat. (About the actual support) I usually affirm her (art) work. For example, I take pictures of her when she goes to an exhibition. We hang out together. I often use her as a model. Just like this kind of thing. We go out and play together, having enjoyable moments physically and mentally. (P4, 235-240)

### 5.3.5.2 Demanding preparations

If a student decided to visit the healthcare services, such as the GP, they would prepare a range of things before the visit. However, the preparation process may not be as easy as it seems. As mentioned in Sections 5.3.2.2 and 5.3.3.3, students spend time and effort searching for information online to make sense of the illness and learn to use medical terms in English. Many interviewees used both English and Chinese to search for results. For example, P6 uses Baidu (A Chinese search engine) to understand the symptoms first and then translates related medical concepts into English terms and uses Google to see how these English terms are used in the English context. She felt that finding “the right” terms was not easy. “It's very difficult to search online, what I mean is that you can't find an accurate and precise expression for your condition. You would need to spend a lot of time searching (P6, 123).”

The reason that Chinese students use Chinese to search for and understand symptoms, as explained by P11, is due to biological differences between Chinese and Western people and diagnostic criteria differences between China and the UK.

Because I feel that I am Chinese, my body condition should be different from foreigners (Western countries). This explains why the suggested recovery period (for broken bones) is different between the UK and China. For example, my friend who had a broken bone was advised to have a shorter recovery time in the UK compared to the same condition in China. I took blood tests when I had some minor illnesses in the UK, The criteria of key indicators were also different from those used in China. Therefore, I feel that the body conditions between Chinese and foreigners (people from Western countries) must be different. Thus, I prefer to use Chinese first (to search for patients' cases) to understand my symptoms. (P11, 71, 73)

Apart from the linguistic and communication difficulties, another reason that students use English to search for symptoms is that they believe that English websites are more credible than Chinese ones. P10 expressed a strong distrust towards Baidu (P10, 76) as there is no authoritative source in Chinese (P10, 76). P11 added that search results returned from Baidu are usually “FAQ” posts from random platforms. You do not know who answers the question (P11, 65). P8 alerted that there are a lot of “weird things” (misinformation) from online posts. She felt that the symptoms found online may be exaggerated and scary.

Let's say I am uncomfortable, and after searching for information online, I may get the feeling “Oh no, I caught an incurable disease and I am going to die” [laughter]. Because there are many kinds of diseases. A symptom can be a result of disease A or disease B. Online materials only

describe a possibility, right? They cannot determine what you have had. So you will see exaggerated illness descriptions. (P8, 420)

To prevent misinformation, P8 “cross-validated” her findings using both Baidu and Google (which is considered to be better at searching English websites). She uses Baidu posts to have an initial sense of the condition and then uses the NHS websites (which were returned by Google) to deepen her understanding.

(Why do you use both Chinese and English to search for medical information?) Humm... To look at the difference between the two. Because sometimes information in Chinese is very unreliable, I will use both languages so that the result is more reliable and trustworthy. (Which one do you feel is better? Chinese or English) I feel that English ones are more trustworthy because there are results from the official NHS website. It is a credible source. Chinese results are mainly from Q&A platforms; there might be doctors’ answers, but I don't know who they are and where they are from. The English ones are more trustworthy in general. (P8, 484-487)

Even after the preparation, students may still feel “emotionally demanding”. They may still be worried about visiting healthcare services. Some interviewees felt that they were a bit nervous when having their first healthcare visit. P11 uses the word “uncertain” to express his first healthcare visit.

This was my first time visiting the GP I felt a little nervous because sometimes when you try to express your feelings in another language, especially when you have never used a certain word (medical term) before, and you don't know whether it's accurate, you will feel a bit uncertain. (P7, 286)

### 5.3.5.3 Tactics to overcome difficulties

Other than preparations being done, students used a number of tactics to overcome difficulties if they decided to visit healthcare services. First, as described in Section 5.3.1.2, students have been concerned about the waiting time to reach the GP. To get quicker appointments, some interviewees describe their conditions in a “very serious” way when booking appointments. If she has an unknown condition, she would describe the condition “exaggeratively”, as she felt that “you never know where they will put you in the queue (P7, 526).”

(If you have an unknown symptom, how would you describe that to the doctor?) Umm... I might tell him that I need a full-body checkup and

that I suspect I might have cancer or something. [laughter] I'll exaggerate a bit to "scare" him, and then ask him to arrange it for me. (Because) I know that, in general, the national healthcare system, for any country, will always prioritise serious cases. If you don't describe your situation seriously, you don't know when they will put you in the queue. (P7, 526)

Another advantage of taking the condition seriously is to prevent superficial diagnoses. As mentioned in Section 5.3.1.1, the GP's consultation only lasts for 10 minutes. The doctor does not have time to think about your case if you make your need explicit. After P9 visited the doctor for his wrist pain, but was advised to do nothing. As a result, he suffered the pain for 2 more months. He then reflected that his description may be "too mild" to make the doctor take him seriously. He would "give more detail" if similar things happened next time.

That consultation was straightforward. I told the doctor that I was having wrist pain, and the doctor told me it would be fine. It will recover itself within a month. He just asked me to monitor it.... But at least I think what I had described at that time was too "mild". I did not attract enough attention from the doctor, as the wrist pain gradually got better after 2 months. (P9, 227, 235)

Second, to overcome communication difficulties raised in the doctor's consultation (as mentioned in Section 5.3.1.1), some interviewees keep themselves proactive, i.e., interrupt the conversation and ask questions actively. They would ask the doctor directly for clarification as soon as they encounter an English term or a medical concept that they do not understand. For example, P9 came across around 10 medical concepts while he was discussing his wrist pain problem. Every time he found a medical concept that he was not familiar with, he asked the doctor directly. He "learned concepts from asking (P9, 100-106)." Similarly, P6 would ask the doctor to pause the conversation so that she has time to look up the word that she did not know online.

If there is a word I really don't know, I'll look it up. Maybe it's a word used in the conversation that I don't know. I'll look it up in real time. The doctor will wait for you to do so and continue the conversation after you have looked it up. (P6, 132)

In addition, to ask questions proactively, P6 reflected that "being clear about the need" is critical for efficient doctor-patient communication.

(During my third time of GP visit) I was very clear about my condition. With a clear goal in mind (requesting sleeping pills), I described my condition in a targeted way.... Eventually, the doctor agreed to prescribe

me some further sleeping pills, but with different compositions. It only takes about 10 minutes. (P6, 217, 224)

Third, as students are not familiarised with the treatment process in the UK (Section 5.3.1.2), some interviewees may be “planning ahead” even before they have any conditions. During the interview, P9 asked the interviewer about the difference between purchasing medicines from pharmacies, supermarkets and the NHS (GP). He asked this question because he was confused about where to seek help, and he wanted to “FangHuanYuWeiRan”. That is, take precautions beforehand to avoid potential danger.

Sometimes I also think about questions like “What if I get sick?” or “What should I do if I run into a situation?” It is a precautionary way of thinking about things, “FangHuanYuWeiRan” after all. It is always better to plan ahead rather than wait until the condition happens and then think about a solution. (P9, 401-405)

Asking about other people’s healthcare experiences is also a common way used by interviewees to familiarise themselves with healthcare services in the UK. For example, when considering dentist registration, P8 asked her friends and eventually registered with a private dentist who has Chinese nurses. “They recommended to me as their patients are all Asians, and doctors and nurses there know Chinese (P8, 250).” “Having a translator is very convenient (P8, 256).” As mentioned in Section 5.3.3.2, P7 learned the way to book the HPV jab from her friends’ experiences and eventually booked her first HPV jab successfully. P9 learned what to do under urgent conditions from his classmate’s broken bone experience.

I asked them in person. Because they were talking about having the second HPV jab at that point tomorrow, I asked them about how they booked for the first jab. I asked them because I want to familiarise myself with the booking process. (P7, 45)

I had a classmate before, who broke his bone in an accident. He called 999 directly and was sent to the hospital. I knew nothing about the emergency service before. After hearing about his experience, I thought that at least all his problems were handled by the NHS, so I don't worry about it that much [laughter]. (P9, 423)

## 5.4 Discussion

### 5.4.1 Theory formation

From the result section, we know that there are 5 categories for describing Chinese students' healthcare services utilisation behaviours: "Perceived difficulties to use", "Attitude towards UK healthcare services", "Social influence", "Direct motivation to use" and "Post-decision Behaviours".

"Perceived difficulties to use" describes difficulties that Chinese students consider to be difficult to deal with when considering using healthcare services. Within this category, the "language and communication barrier" describes Chinese students' concern about not knowing English medical terminologies and not having a "common ground" for doctor consultations. "Organisational disorientation" describes Chinese students' concern about navigating the process of arranging healthcare service utilisation as well as the effort required for specialised care services. "Emotional and cognitive burdens" describes Chinese students' emotional fears about visiting healthcare services and diminished cognitive ability in emergency conditions. "Interpersonal barrier" describes Chinese students' dilemma in gathering interpersonal and social resources to help them seek professional advice. "Sociocultural matters" listed a number of sociocultural factors that impede Chinese students' healthcare service utilisation, such as the need for TCM practices, the positionality between doctors and patients, differences in living styles, and cultural taboos.

"Attitude towards UK healthcare services" describes Chinese students' impressions, attitudes, and feelings towards UK healthcare services, as well as their internal reasoning for visiting or not visiting the service. "Impression towards the NHS" describes Chinese students' general perceptions of the NHS. Most interviewees believe that the NHS is low, effort-consuming and sometimes unprofessional. "Time, effort and benefit evaluation" describes Chinese students' internal decision-making process. They feel reluctant to use healthcare services in the UK because they need to put in a lot of preparation but receive limited returns, such as superficial diagnosis and being refused to obtain prescriptions. "Personal beliefs" describe Chinese students' expectations of what UK healthcare services can do. Some interviewees misused the emergency services, while other interviewees overestimated what the primary service can offer. They criticised the UK system for being "over-conservative". "Perception of values" describes the feeling towards UK healthcare services. Many interviewees were dissatisfied with the fact that healthcare professionals were neglectful, dismissive, non-informative, and unprofessional.



“Social influence” describes the influence of other people on Chinese students’ behaviour in using healthcare services in the UK. “Influences from family” describes the influence of family members on the student. On one side, a student may gain motivation from their family members to seek professional help if family members advise them to do so. On the other hand, a student may be hesitant to reveal their medical problems to their relatives as they do not want them to worry. “Influences from peers” describes the influence of people around Chinese students. Students may consult their peers to make sense of the illness and then make healthcare visit decisions. They also exchange experiences through small talk to make sense of the treatment process. They will also share unpleasant experiences in the form of “TuCao”, which makes the listener develop bad impressions. “Influence from online” describes the impact of health information online. Students search online to learn about the illness that they are suspicious of, and they will also become familiar with the treatment procedure by reading online materials. “Influence from social environments” describes the impact of the wider environment on the student, other than the people they know or the health information online. Interviewees felt that schools and universities play a key role in supporting them. Universities should let them know they will be supported if they run into problems. Public opinions on social media will also affect students’ decisions to use healthcare services.

“Direct motivation to use” describes individual-dependent motivations about students’ healthcare utilisation behaviour. The first is severity. If the health condition is beyond the student’s control, they will seek professional help. For example, they run into an emergency, or they have a chronic illness which needs medical intervention. If it is a minor illness, then they will be less likely to seek professional help. The second is personality traits. Students may feel “lazy” to utilise the service, and they believe in their healthy bodies and their ability to handle themselves. Students may position themselves as “sojourners”. They might think that they will only receive treatment for a limited period of time from the NHS, which will not help them much. The third is practical reasons. Students will consider their financial state (private services), school workloads, and mobility when deciding on healthcare service utilisation.

“Post-decision behaviours” describe Chinese students’ actions and practices that they undertake to manage their health in the UK. “Alternative management behaviour” describes Chinese students’ practices other than seeking professional advice. For minor illnesses, students may ignore them first, then use medicine second, and go to see the doctor as their last resort. If students decide to go to see the doctor, they have to get it prepared. Students prefer to use Chinese to search online to make sense of the illness, and use English to search online to validate. Students use a range of tactics during their healthcare service utilisation. Before the visit, they may ask their friends to familiarise themselves with the treatment process. During the visit, they may exaggerate their condition so that the doctor would take them seriously. If they

encounter a word or concept that they do not understand, they may interrupt the conversation and ask the doctor for an explanation until they understand it.

We found that these 5 categories fit together under the Theory of Planned Behaviour (Ajzen, 1991). This is a psychological framework that explains the process of decision-making and human behaviour (Chapter 2, Section 2.3.4). According to Ajzen (1991), human behaviour is determined by the intention of that behaviour. This intention is determined by the perceived behavioural control, subjective norms and attitude towards that behaviour. Perceived behavioural control is defined in terms of self-efficacy, i.e., a person's level of confidence (ability) to perform that behaviour. Attitude is defined in terms of outcome expectancy, i.e., a person's evaluation of the likelihood of producing the desired outcome. Subjective norm is defined in terms of the views of other people about that behaviour (approval or disapproval of that behaviour). Behavioural intention is defined in terms of motivational factors to perform that behaviour, where a high intention refers to a strong motivation to perform that behaviour, and vice versa. Perceived behaviour control, subjective norms and attitude determine the behaviour intention, and the intention contributes to the likelihood of an individual carrying out the planned behaviour.

In the case of Chinese overseas students using healthcare services in the UK (i.e., the utilisation behaviour), our category "Perceived difficulties to use" includes difficulties that Chinese students consider to be difficult to deal with for using healthcare services. Our finding shows that there exists a number of "self-inefficacies" in visiting healthcare services. Students may run into language and communication difficulties such as not knowing English terminologies and hard to articulating medical concepts when talking to the doctor (language and communication barrier); they do not know how UK healthcare services work and find it hard to make appointments (organisational disorientation); they might be reluctant to face the unknown (emotional barrier); they have limited social and interpersonal resources to seek other's help (interpersonal barrier); they may be affected by their sociocultural background to discuss health matters with UK doctors. These "self-inefficacies" weakened students' motivation to use healthcare services, as students have to conquer these problems to have a smooth visit. This links to the construct of "Perceived behavioural control" in TPB.

Our category "Attitude towards UK healthcare services" includes Chinese students' impressions, feelings and expectations of UK healthcare services. Our finding shows that Chinese students hold a mixed impression of the NHS, with a strong negative impression that the NHS is inefficient and ineffective. They consider health visits to be "effort-demanding". This links to self-efficacy, where students need to overcome difficulties that are considered hard to deal with. They also consider it hard to obtain the desired outcome, such as asking for prescriptions and specialist referrals. They hold higher expectations of what the GP can do, and they are often dissatisfied with the quality of the service, pointing out that some healthcare professionals are

dismissive, uninformative, and unprofessional. Based on these negative aspects, students generally may be unfavourable to seeking professional advice, thinking that it is “useless” to go see a doctor. This links to the construct of “Attitude towards the behaviour” in TPB.

Our category “Social influence” includes the influence of other people on students' healthcare services visit behaviour. Students receive “approval” and “disapproval” from multiple sources. Students' family members may encourage the student to “have a check” if they have problems. However, they will hear “TuCao” (sharing negative experiences) from their peers, warning that the service is inefficient and troublesome to use. Students may reconsider their decision and re-estimate the effort they have to put in based on experiences they learn from peers. This “reconsideration” links to the “Perceived difficulties” and “Attitude towards UK healthcare services”. Apart from peers, students may also search for health information online. However, they have to disambiguate misinformation. As for the social environment, some universities do not have, or students are not aware of, the policies and services which support them to manage health conditions. Students may feel isolated and helpless when considering health visits. This links to the construct “subjective norm” in TPB.

Our category “Direct motivation to use” contains three individual and context-dependent motivations for Chinese students using UK healthcare services. As for “severity”, Chinese students may be less likely to seek professional help (even GPs) if it is a minor condition. As for “personality”, some students may simply ignore their condition, simply because they are “lazy”. They are confident about their bodies. As for “practical reasons”, some students see their financial status (for going to private services), heavy school workloads, and immobility (they live far away from the service) as causes that reduce their intentions to seek professional help. Our category “Post-decision behaviour” illustrates what Chinese students will do when they experience discomfort. This category describes common “Behaviours” that students would do after making a decision. If a student has a low intention to visit the healthcare service, they would “ignore the symptom”. They would also use TCM that they brought from China or borrow medicines from their peers (i.e., Self-intervene). They may also consider going to the pharmacy to buy Western medicines. If the student has a high intention to visit the healthcare service, they may spend time searching for information online to prepare for the visit.. The final theory to explain Chinese students' behaviour in using UK healthcare services is illustrated in Figure 5.4 (c.f. Figure 2.6).

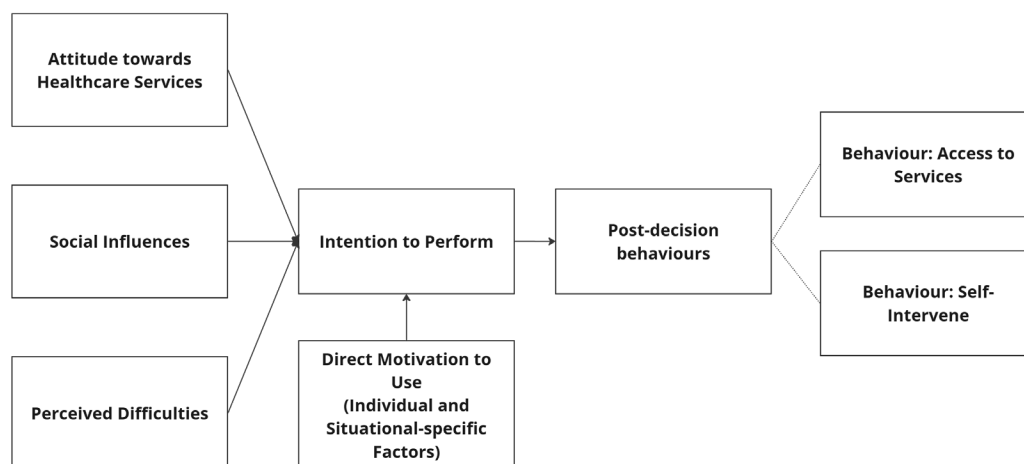


Figure 5.4 A conceptual framework of Chinese overseas students' behaviour in using healthcare services in the UK (c.f. Figure 2.6)

To conclude, the “Perceived difficulties to use”, “Attitude towards UK healthcare services”, and “Social influence” are the 3 determinants for healthcare service utilisation. Together with the context and individual and situational-dependent category, “Direct Motivation to use”, these 4 categories form the intention of healthcare service utilisation. The intention of healthcare service utilisation determines which behaviour the student will perform. A strong intention will result in the student seeking “professional” advice such as visiting GPs or specialists, whereas a weak intention will result in the student neglecting or self-handling the discomfort.

#### 5.4.2 Related work

Our study shows that Chinese students prefer to self-intervene or seek help from their peers over seeking formal help. More specifically, we found that it is common for Chinese students only seek professional help only once they have exhausted all possible self-management options. This abnormal service usage pattern is also reflected by other studies. Smaje & Le Grand's (1997) quantitatively measured healthcare service utilisation by the use/need ratio (self-reported/doctor-intervened), where they found that Chinese immigrants were significantly less likely to utilise healthcare services than Caucasian Americans, showing that Chinese immigrants are underutilising healthcare services. We attribute this phenomenon to perceived difficulties of use, negative attitudes towards healthcare services and social influences. Our results also align with many other studies specific to overseas students. Under the “Perceived difficulties to use” category, we found that Chinese students may encounter language and communication problems while speaking to the doctor. This aligns with Wang's (2017) findings, as they reported that the language problem prevented Chinese students from accessing NHS services. However, in contrast to other studies which regard the language barrier in the context of students' daily lives

(Lu et al., 2014; Ching et al., 2017), our study highlighted that understanding medical terminologies in English and articulating medical symptoms and needs are the two main aspects that students find hard to deal with. Our results showed that **students may struggle to communicate with the doctor even if they can speak English proficiently in daily and academic contexts**. While Li et al. (2014) showed that English language proficiency was closely associated with students' intention to seek mental well-being professionals, our study found that this also applies to physiological contexts. According to Ngo-Metzger et al. (2003), immigrant patients desperately need help in navigating healthcare systems. Our results confirm this result, as **common Chinese students are indeed unfamiliar with how the healthcare system functions in the UK**. They might misuse care services such as calling 999 for period pain. They might hold misconceptions about GPs, expecting them to conduct specialised examinations. For interpersonal barriers, Wang (2017) found that Chinese students may be hard to integrate into UK society as they need to familiarise themselves with “cultures”, e.g., church culture, pub culture, sports and campus culture, etc. Our findings are more specific to access to healthcare services. We showed that **Chinese students may have no close friends for help, and they have limited “relations” and social relations and resources**. For sociocultural matters, our findings showed that Chinese students may sometimes use TCM and concepts to perceive and articulate their discomfort. This was described by Kleinman (1978), who claimed that the illness is culturally dependent. People from different cultures will perceive the same disease differently. This may cause problems as doctors in the UK did not recognise TCM concepts (D. Wang, 2017). Another sociocultural problem is related to taboos. We found that **Chinese students are reluctant to seek professional help for certain illnesses, in particular, mental well-being and sex-related problems**. This pattern is confirmed by Lu et al. (2014), who reported that Chinese students often “perceive emotional problems are not severe enough to warrant treatment,” and is confirmed by Gao et al. (2016), who found that it may be embarrassing for Chinese students to discuss HPV vaccination topics in person with professionals.

Under the “Attitudes towards the UK healthcare services” category, we found that Chinese students hold an overall negative view towards the NHS. They worried that they had to spend a lot of time and effort to arrange a medical appointment, but with little or no return. This was also found by Wang (2017), where some Chinese students felt that they are not seeing a doctor when they think they should, and the GP’s service is inadequate to meet their needs. While we found that Chinese students felt that the NHS staff are friendly but not helpful (e.g., GPs diagnosed students superficially), Wang (2017) showed that some GPs were not that friendly and they did not show a genuine interest in asking about their illnesses or listening to their concerns. As for mental well-being, we found that the counselling service is often perceived to be useless among Chinese students. This aligns with other quantitative survey studies where Chinese students hold a negative attitude towards professional counselling services and tend

to avoid using them (Lim et al., 2016; Yoon & Jepsen, 2008). However, our finding shows that students may feel that the on-campus counselling service is useless even if they are aware of its existence. This contradicts Chen et al. (2020) survey results, which claim that the awareness of on-campus counselling services is a mediating factor for Chinese students' attitudes towards seeking professional help.

Under the "Social influences" category, we found that Chinese students tend to seek informal help often before planning to attend professional services. They rely on online search engines and experiences from their peers to make sense of the illness and the treatment process. Similarly, Gale et al. (2021) interviewed Chinese students about their healthcare experiences in foreign countries, finding that they use non-medical sources of advice such as family, friends, the Internet and study abroad agents. This aligns with our findings except that we found that some Chinese students are reluctant to speak about health problems with their relatives, as they do not want to worry them. Apart from "informal medical advice", we also highlighted the influence of the social environment on Chinese students' help-seeking behaviour. Universities' policy on students' health (e.g., illness policy, awareness of services) is a crucial motivator to attend professional services. Public opinions on social media about Western healthcare systems will also affect students' attitudes towards UK healthcare services.

Under the "Direct motivation to use" category, we found that the Chinese students' motivation to use professional services is adversely associated with the school workload. **Chinese students tend to prioritise academic work over their health and well-being, with mental health problems in particular, as some students claim they are too busy to attend counselling services.** This is explained by Wang (2017), where Chinese students usually value academic success as the most important thing in their student life, so other things, such as dealing with minor health problems, can be ignored. We also found that **finances and mobility are the other two practical reasons which prevent Chinese students from attending healthcare services.** This finding is similar to Lu et al.'s (2014) survey about Chinese overseas students' mental health help-seeking behaviour, where they found that students worried about the treatment cost and transportation for attending counselling services. As for "personal traits", we found that **some Chinese students feel that it is "troublesome" to register with the GP, even if they are aware that they should do so.** Ellis-Bosold et al. (2013) attributed this phenomenon to the "lack of responsibility for their own healthcare needs". Our results complement this result, showing that **Chinese students may position themselves as "sojourners", and thus expect them to be "deprioritised" by the UK healthcare system, e.g. being diagnosed superficially.**

Under the "Post-decision Behaviours" category, we found that Chinese students may describe their symptoms in an exaggerated way to attract the doctor's attention to avoid superficial diagnoses. Wang (2017) shared the same result, where they found that Chinese students described themselves "as if they are dying" to cope with the

GP's unwillingness to take examinations. As for online information-seeking behaviour, our result shows that **Chinese students rely on online resources to make sense of the illness and treatment process**. However, studies have shown that information about medical treatments is one of the most prevalent types of misinformation online (Suarez-Lledo & Alvarez-Galvez, 2021). Chinese students have to spend time and effort to identify authentic information. To do this, **they use the Chinese-specialised search engine, Baidu, to make an initial sense of the illness, and then use the English-specialised search engine, Google, to deepen and confirm their understanding**. This “cross-validation” behaviour confirms a proposition proposed by Wang & Chang (2022), where Chinese students tend to use multiple international sources of information to differentiate health misinformation.

To conclude, our findings align with many other studies, confirming that Chinese overseas students are reluctant to utilise healthcare services. Our findings complement most existing studies, extending pre-existing knowledge about Chinese overseas students to the context of healthcare utilisation.

#### 5.4.3 Design Implications

Our analysis shows that Chinese students' decision-making process of healthcare service utilisation includes 5 categories, i.e., “Perceived difficulties to use”, “Attitude towards UK healthcare services”, “Social influence”, “Direct motivation to use”, and “Post-decision behaviours”. Among these 5 categories, “Perceived difficulties to use”, “Attitude towards UK healthcare services”, and “Social influence” are 3 determinants for healthcare service utilisation. Together with the context and individual-dependent category “Direct motivation to use”, form the intention of healthcare service utilisation.

The “Direct motivation to use” varied among students by individuals, so making changes in this category may not be generalisable. For example, it is simply not viable for designers to shorten every Chinese student's distance to visit GPs and hospitals.

However, designers can make generalisable improvements under the 3 key determinants category. Whether to seek professional help is dependent on the student's self-efficacy, the ability to conquer difficulties that will arise in healthcare service utilisation, the outcome expectancy, the perceived usefulness of arranging healthcare service utilisation, the social influence, the “approval” or “disapproval” views that people around the student hold.

To encourage Chinese students' healthcare service utilisation, one way that designers can help is to improve self-efficacy, i.e., to reduce Chinese students' perceived difficulties in using healthcare services. For example, helping Chinese students to know what healthcare services are available in the UK, and how to access them. Designers may also focus on changing Chinese students' attitudes towards healthcare services.

For example, helping Chinese students to shape realistic expectations of what a service can do, and what the potential outcomes of going to the service. Last but not least, designers can try to increase the public image of UK healthcare services in the Chinese students' community. For example, by encouraging students to share positive healthcare experiences that they have experienced with the healthcare system, and answering students' concerns about negative experiences. Thus, it creates an informative and supportive social environment for the Chinese student community.

#### 5.4.4 Limitations

We developed an explanation framework for Chinese students' healthcare utilisation behaviour in the UK. However, this study has some limitations.

The first one is about the assumptions of the theory of planned behaviour. Although the theory of planned behaviour (Ajzen, 1991) has been successfully used to explain many health-related behaviours, such as choice of leisure activities (Ajzen & Driver, 1992), exercise (Nguyen et al., 1997) and diet (Conner et al., 2003), it does not explain irrational human behaviours, i.e. behaviours that are or cannot be planned. For example, the theory of planned behaviour is ineffective in explaining human behaviour related to addiction, such as smoking and alcohol addiction. In our case, contexts such as people going to the emergency department under life-threatening conditions will not be explained effectively by our theory, as these contexts are "unplanned". People are "forced" to go to the emergency department in life-threatening conditions regardless of their perceived difficulties, how other people think, and their attitudes towards the UK healthcare system.

The second limitation is regarding the procedure of conducting Grounded theory. Due to time and resource limitations, we simplified the theoretical sampling process. In the original Grounded theory, each interview should be formally coded before the next interview; however, we did not code the transcript before hosting the next interview. Instead, we compare existing interview schedules and previous memos to determine if we want to continue the data collection. The formal analysis took place after we finished collecting all the interviews. This may affect the representativeness of the data. Our data would not be as fully saturated as we would have thought.

Next, we collect the data in the form of unstructured interviews. While this has the advantage of collecting data without setting boundaries, i.e., being explorative about Chinese students' healthcare experiences, interviewees only report things that they can remember, such as events that affected them profoundly. It is hard to collect details about specific moments, e.g., what you feel hard at this moment, actions, e.g.,



what you did at that moment, and pain points, e.g., why you did this, and what can be improved at that moment.

Finally, since we focus on Chinese overseas students, the validity of applying this theory to other communities is unknown. Some of the findings may align with broader communities such as Chinese immigrants (e.g., language barrier, sociocultural matters) and other international students (e.g., organisational disorientation). (limitation-implication) In addition, the data collection is restricted to Edinburgh, so our findings may be biased towards Chinese students who live in Edinburgh or Scotland.

#### 5.4.5 Conclusion

In this chapter, we used the Grounded theory method to collect Chinese overseas students' healthcare experiences in the UK. We managed to collect a data set of 11 Chinese overseas students about their healthcare experiences in the UK, with a particular focus on healthcare services utilisations. In general, we found that Chinese students prefer to self-intervene or seek help from their peers. They prefer not to go to formal healthcare services unless necessary [RQ1.1]. We found that Chinese students commonly hold a negative attitude towards healthcare services in the UK, particularly about the fact that the NHS is inefficient and ineffective [RQ1.2]. We found a range of difficulties that Chinese students may experience during healthcare service utilisation, including language and communication problems, organisational disorientations, emotional and cognitive burdens, interpersonal barriers, and sociocultural differences [RQ 1.3]. Through two iterations of qualitative coding, we categorised 5 core concepts for explaining Chinese students' behaviour in using healthcare services in the UK, i.e., "Perceived difficulties to use", "Attitude towards UK healthcare services", "Social influence", "Direct motivation to use", and "Post-decision behaviours". Our findings fit into the framework of the theory of planned behaviour, showing that "Perceived difficulties to use", "Attitude towards UK healthcare services", and "Social influence" are the three key determinants for healthcare service utilisation. The key contribution of this chapter is listed below:

1. Collected a comprehensive set of data about Chinese overseas students' healthcare experiences in the UK, with a particular focus on healthcare service utilisation. This includes but is not limited to access to the GP, dentists, pharmacies, mental health counselling services, and hospital specialists.
2. Developed an explanatory framework of Chinese students about their behaviour in healthcare service utilisation in the UK based on the theory of planned behaviour.
3. Inferred key areas for intervention, which guide directions for the chatbot development

## Chapter 6: Co-design Workshop

### 6.1 Introduction and Motivation

This chapter describes a co-design workshop which investigates Chinese overseas students' experiences with regard to healthcare service utilisation in the UK. While Chapter 5 includes Chinese overseas students' general health management behaviour, this chapter focuses on exploring design opportunities in supporting Chinese overseas students and design requirements for designing chatbots. This chapter answers questions such as: What obstacles are preventing Chinese students from accessing UK healthcare services specifically? What support do Chinese students want and need? How can we design a chatbot to support them?

From Chapter 5, we know that Chinese students hold a negative attitude toward healthcare services in the UK. They may only seek professional help as a final resort, resulting in delays for proper treatment. As explained by the theory of planned behaviour of healthcare service utilisation, the "Perceived difficulties to use", "Attitude towards UK healthcare services", and "Social influences" are the three key determinants for healthcare service utilisation. We highlighted three possible approaches to encourage Chinese students to utilise professional services, i.e., by improving "self-efficacy", raising "outcome expectancy", and increasing "affirmation" to use healthcare services in the Chinese student community (Section 5.4.3).

As discussed in Chapter 3 (Section 3.2.4), chatbots possess some unique characteristics for encouraging healthcare utilisation. Chatbots are accessible, interactive and promotive. They might be used to inform students about what to do and what to expect, and to affirm students about their choices. The purpose of this chapter is to unfold Chinese overseas students' healthcare service journeys and identify pain points. This chapter uses two co-design activities, journey mapping and storyboarding, to scrutinise Chinese students' pain points and see how these can be addressed in the form of chatbots. The goal of this chapter is to investigate design opportunities for chatbots to support Chinese students when they seek professional help. Specifically, this chapter answers the second research question listed in Chapter 1.

**[RQ2]:** How can a chatbot be used to address problems that Chinese overseas students have in their engagement with UK healthcare services?

To answer [RQ2], the following sub-questions were investigated:

[RQ2.1] What kind of healthcare journeys have Chinese overseas students experienced?

[RQ2.2] What are the pain points in these healthcare journeys?

[RQ2.3] What are the design opportunities for a chatbot to be used to support them, as envisaged by Chinese overseas students?

To answer the above questions, we used a co-design workshop to examine students' healthcare journeys. By the end of this chapter, we accomplished the following things:

1. We collected 8 Chinese students' experiences about their journeys in accessing UK healthcare services. We carried out content analysis and summarised workshop materials from a service design angle. The result shows that students utilise healthcare services for various purposes, including dealing with administrative matters and resolving minor, chronic, and urgent conditions.
2. We carried out the thematic analysis of workshop transcripts to look closely into participants' healthcare journeys to examine pain points and their requirements for chatbots. We identified 7 types of difficulties and 5 types of dissatisfaction in their healthcare journeys. We also identified 5 types of chatbot designs.
3. We highlighted a list of design opportunities and discussed design requirements for the chatbot implementation.

Our results show that Chinese students use UK healthcare services to: 1. deal with administrative matters, 2. minor illnesses, 3. chronic illnesses and 4. urgent conditions or emergencies. They have problems with GP registration, familiarising the NHS's treatment process, handling urgent and emergency conditions, accessing care for chronic treatments, resolving minor conditions, familiarising UK medications, and spending effort in online searching. Students with different levels of acculturation encounter different problems. New students are likely to encounter administrative problems; adapting students are likely to encounter consultation and disorientation problems; acculturated students are likely to encounter expectation and dissatisfaction problems. Students proposed a range of chatbot features to support their healthcare utilisation, including an agent to provide information, an educational tool for preparing consultations, a portal for interaction and a supportive tool for reassurance.

Findings from this study define a set of design opportunities and design requirements for the chatbot design. While the health journey activity identified specific pain points in healthcare service utilisation, the storyboarding activity illustrated how participants would like to use the chatbot for support. With concrete design opportunities and requirements, we are ready to implement the chatbot prototype.

## 6.2 Method

### 6.2.1 Study Design

As mentioned in Section 3.3.2, we used co-design workshops to investigate Chinese overseas students' healthcare journeys in the UK. In the workshop, we decided to use Journey Mapping with card sorting as the activity to understand students' healthcare utilisation process, and we used Storyboarding with roleplaying as the activity to conceptualise designs. Journey mapping is a service design method that visualises an individual's experience that they go through to achieve a goal (Gibbons, 2018) in the form of a chronicle map. It was originally used as a research tool to improve experiences by illustrating customers' actions, thoughts and the problems users encountered in using the service (Stickdorn & Schneider, 2011). Journey Mapping depicts people's experiences in chronicle order. It visualises interactions between the individual with the service, giving a holistic overview of the experience (Howard, 2014). Since healthcare services are complex, interrelated, and possibly challenging to navigate (Griese et al., 2020), in healthcare research, people utilise Journey Mapping to observe healthcare engagements from the perspective of patients to gain a deeper understanding of the process, identify problems and develop improvements (Davies et al., 2023; Trebble & Hydes, 2011). According to McCarthy (2016), the journey map externalises insights and knowledge holistically from the patient's perspective. It promotes empathy, identifies issues, and highlights room for improvement. In our case, we use Journey mapping to holistically document, identify issues and gain insights into Chinese students' healthcare journeys in the UK.

Storyboarding is another service design method that uses a sequence of images and captions chronologically to depict a story. In contrast to journey maps, which illustrate the big picture, storyboards are usually used to illustrate context-rich, detail-oriented fragments of the user journey. Storyboards are used as an efficient tool for communication between stakeholders by using images and text to establish the context and common ground (i.e., the situation) (Krause, 2018). In the healthcare domain, storyboards help to visually contextualise patients' interactions with the healthcare service (i.e., touchpoints) (McCarthy et al., 2016). Storyboards have been used as a communicative tool. Many studies used storyboards to educate healthcare professionals to understand things from the patient's perspective, and thus improve service quality (Hetherington, 1999; Tsianakas et al., 2015). Storyboards have also been used to document ideations when designing healthcare technologies. People sketch out ideas of how they may interact with the healthcare service. For example, Hoang et al. (2018) used of "storybook" (an alternation of the storyboard) to depict patients' stories as fiction. Ståhlberg et al. (2016) developed an interactive storyboard for children to help them illustrate their own clinic visit experiences. Storyboards offer

an efficient way to record the design context and generate preliminary design ideas. In our case, we use Storyboarding to capture design requirements for chatbots to improve Chinese students' utilisation experience.

### 6.2.2 The pilot study

We started to formulate the co-design workshop by running pilot studies. Pilot studies aim to test whether the co-design tasks can generate meaningful data (i.e., data can answer the research questions) and whether the flow of the workshop makes sense to participants. Due to COVID restrictions, the workshop protocol was designed in a 1-to-1 format. We ran the pilot workshop with 4 participants, 2 Chinese participants (conducted in Mandarin) and 2 non-Chinese participants (conducted in English). Since we wanted to test out the flow, we did not set a specific time limit for the activities. During each pilot workshop, the facilitator asked the participant to complete a series of activities based on the current version of the workshop protocol. The initial workshop protocol included 3 activities: the journey mapping activity, the experience grouping activity, and the storyboarding activity. After each pilot trial, the facilitator reflected on the following 3 aspects: what went well, what needs to be improved, and how the data relates to the research questions. Then, the facilitator made changes to the workshop protocol. By the end of the pilot study, we had iterated the process 4 times. The final workshop protocol includes 5 activities: the warm-up activity, the journey map activity, the experience grouping activity, the reflection and ideation activity, the storyboarding activity, and the role-playing activity. The details of these activities will be explained in Section 6.2.3.

During pilot studies, we found that some tasks, such as journey mapping and experience grouping, are cognitively demanding. Some questions, particularly associated with identifying difficulties, reflecting needs and suggesting improvements, are hard to answer. Participants either give too few details about their engagement experience and thus no meaningful insights, or give too many details about their experiences and thus get lost in the details. In the final version of the protocol, we made some changes. Firstly, we added a warm-up activity to let the participants become familiar with the goal of the workshop and help them recall a service engagement experience so that they can be better prepared for the upcoming design activities. Second, we simplified the journey mapping activity. We initially asked the participant to talk through an experience and ask them to give details of the experience in 3 dimensions: action, thought, and emotion (see Appendix C2.1). Later on, we found that many experience fragments are inherently non-separable between actions, thoughts and emotions. Filling this kind of journey map (Appendix C2.1) can be time-consuming and effort-demanding, paying attention to trivial things. The final version of the journey map is illustrated in Appendix C2.2, using only “moments” as

experience fragments. This gives a lot of freedom for the participant to decide what should be mentioned on the map.

In pilot studies, we noticed that some participants failed to write down information on the journey map, as they could only identify one or two difficulties in their healthcare journeys. This is because they had a hard time recalling details of the event and found it difficult to think about the associated difficulty. Since we are hosting a 1-to-1 workshop, the participants may have a hard time brainstorming about difficulties by themselves. To facilitate Journey Mapping, we design a set of cards to prompt the participant to generate ideas about events and difficulties. Cards were generated from the initial (open) codes and focused codes, which we originally developed from the grounded theory study, where these codes have been used to describe interviewees' perceived difficulties, attitudes, and behaviours that relate to healthcare service visits. For each code, we paraphrased it into one sentence to make it more readable and natural. We generated a total of 76 "experience cards". To facilitate mapping, we categorised all cards in 2 dimensions: the phase (before the intervention, during/self-intervention, or after the intervention), and the event (either a behaviour or a friction point). An example of cards is illustrated in Figure 6.1. The cards are designed using Microsoft Publisher software. The full list of cards can be found in Appendix C3.

The last improvement we made was on the storyboarding (ideation) activity. We found that the participants struggled to design chatbots immediately after the experience grouping activity, as they needed time to digest the difficulty and make sense of the cause. Thus, we added a set of reflective questions for them to answer before ideation, such as "Why did you pick this scenario for design?", "What do you think is the cause of the problem?", "If the same thing happens in China, what do you think would be different?", "What do you value most?" to smooth the process. At the time they started drawing the storyboard, some participants were uncertain about how much detail they should provide. Thus, we provide an example alongside the blank storyboard. We also added a role-play activity at the end of the workshop. By testing out chatbot conversations that they have designed, they may generate new thoughts and reflections for improvements.



Figure 6.1 An example of cards for card sorting. The phase is shown in the bottom-left corner, and the event is shown in the bottom-right corner. Codes are transformed into sentences and are verified by a native English speaker to make sure that they make sense.

### 6.2.3 Study procedure

The final version of the workshop consists of one warm-up activity and four design activities: journey mapping, experience grouping, storyboarding and role-playing. The overview of the workshop procedure is shown in Figure 6.2.

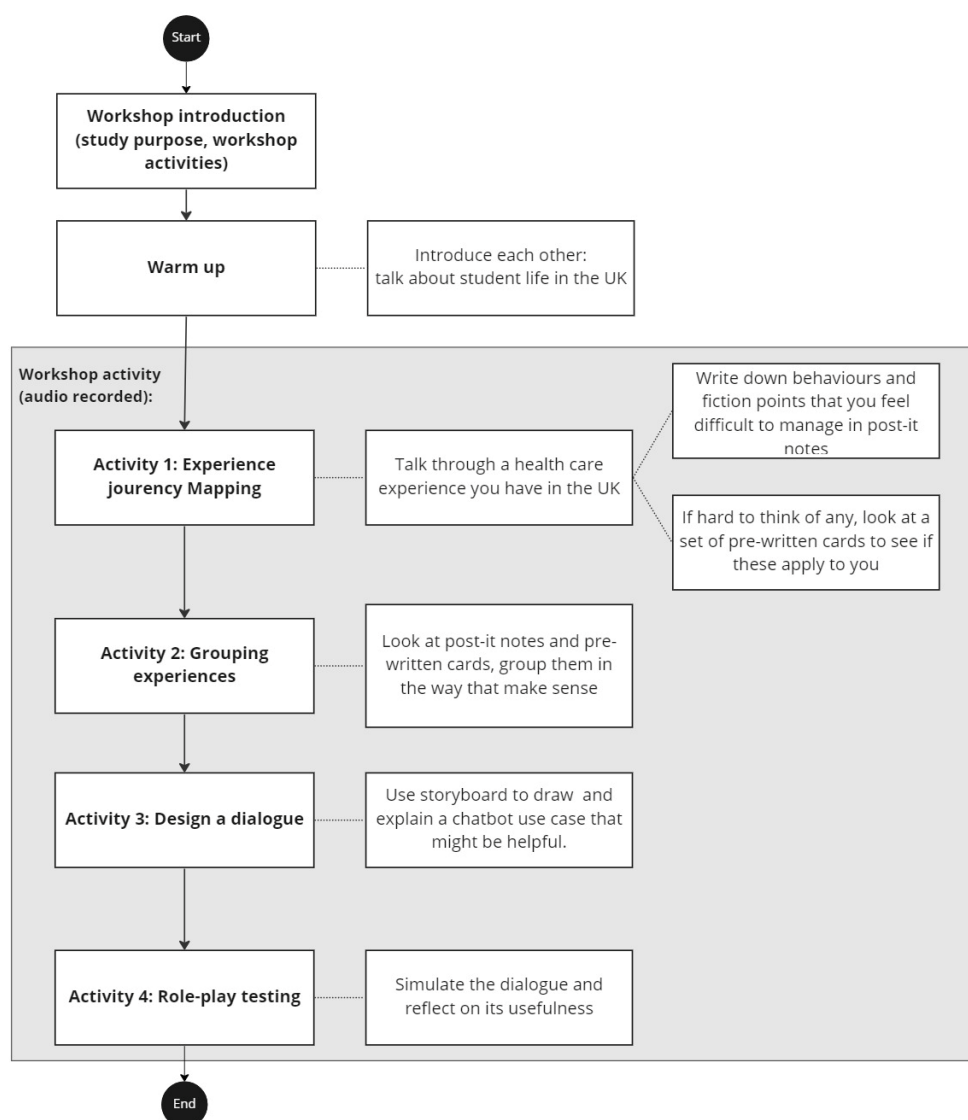


Figure 6.2 The workshop procedure. It includes 1 warm-up activity followed by 4 design activities: journey mapping, experience grouping, storyboarding and role-playing.

### 6.2.3.1 Warm-up activity

First, the facilitator introduces the participant to the study's aim and process. Once the participants signed the consent form, the facilitator introduced themselves and then asked the students to briefly introduce themselves about their student life, e.g., age, length of being in the UK, subject area, and how they feel about it. The purpose of this step is to let the facilitator and the participant get to know each other and collect demographic information. Then, the facilitator asks the participant to briefly describe an experience of their engagement with UK healthcare services (in 3 sentences). We ask the participant to briefly describe their experience because we want the participant to think about the experience that they want to tell. This may help them



recall some of the details that they want to emphasise before diving into the journey mapping.

### 6.2.3.2 Experience Journey Mapping

In the journey mapping, the facilitator first introduces the participant to the experience journey map, with an example (Figure 6.2). Then, the facilitator asks the participant to elaborate on their engagement experience with the UK healthcare services in detail. Specifically, participants are asked to: 1. identify the key events and behaviours involved in the experience, 2. write down these events and behaviours on post-it notes and place them on the journey map, 3. identify friction points involved in these events, i.e., the difficulties and dissatisfactions they have experienced, 4. write down these difficulties and dissatisfactions on post-it notes and place them near the event notes. If the participant finds it hard to recall events or think about difficulties, the facilitator will ask the participant to look through the “experience cards” and see if these behaviours or friction points match their case. The purpose of this step is to let the participant articulate their experiences holistically and chronologically, focusing on key events with their associated difficulties and dissatisfactions. At the end of this exercise, the participant has a journey map annotated with key difficulties. An example of the healthcare service engagement journey map is shown in Figure 6.3. This activity is designed to answer RQ2.1 and RQ2.2, “What kind of healthcare journeys that Chinese overseas students experienced?” and “What are the pain points in these healthcare journeys?”.

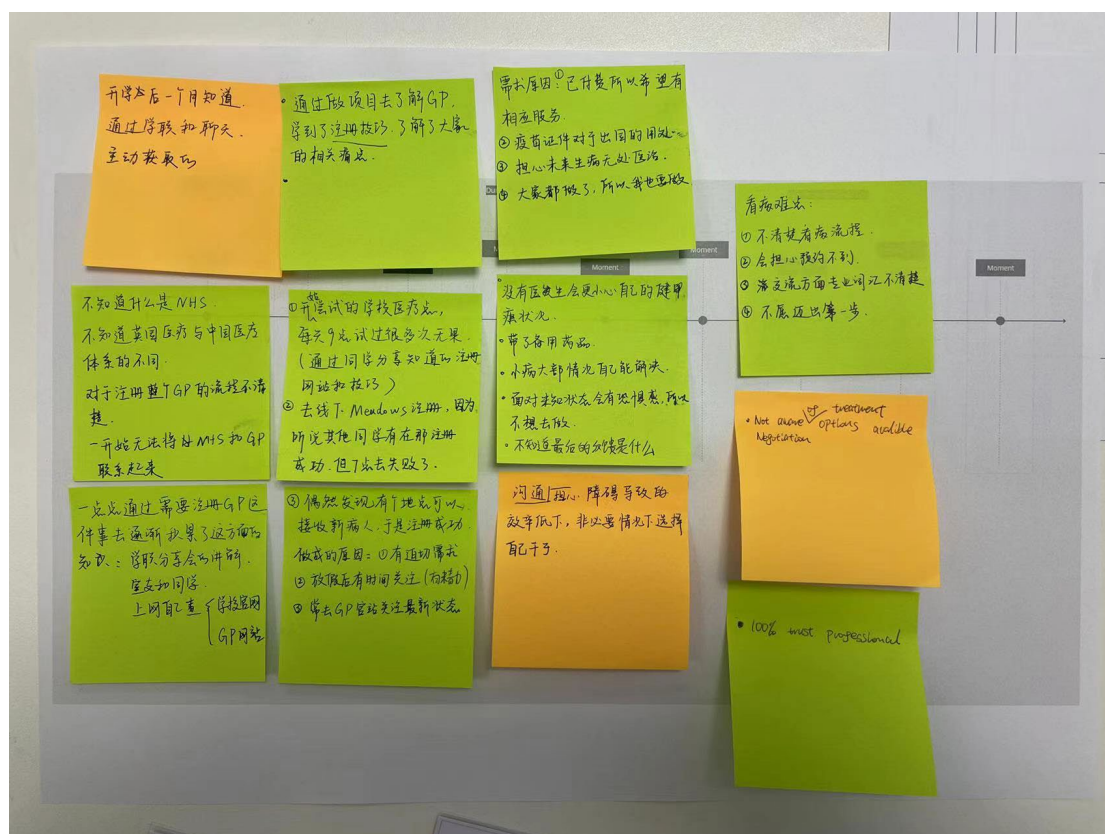


Figure 6.3 An example of a participant's journey map of healthcare engagements. The participant illustrates her experience registering for the GP.

### 6.2.3.3 Experience Grouping

In the experience grouping activity, the facilitator asks the participant to look back at the journey map and asks them to sort their experience segments (i.e., post-it notes) into meaningful groups. There are no restrictions on how the participant group experiences segments, as long as the grouping makes sense to them. For example, the participant can group experience segments by the type of difficulties, or they can group the experience by the type of critical behaviours and thoughts. After the grouping, the participant is asked to name these groups. If the participant finds it hard to group or name experience segments, the facilitator will ask the participant to look back at the “experience cards” to see if any of these cards summarise their experience segments. The goal of this activity is to let the participant abstract away from the details and gain an overall understanding of their healthcare service engagement journey. This helps to uncover the causes of difficulties and dissatisfactions, and therefore think about the pain point that they want to address. At the end of this activity, the participant comes up with clusters of experience segments. An example of the experiencing grouping is shown in Figure 6.4. This activity is designed to

complement the journey mapping activity to answer RQ2.1 and RQ2.2, “What kind of healthcare journeys that Chinese overseas students have experienced?” and “What are the pain points in these healthcare journeys?”.

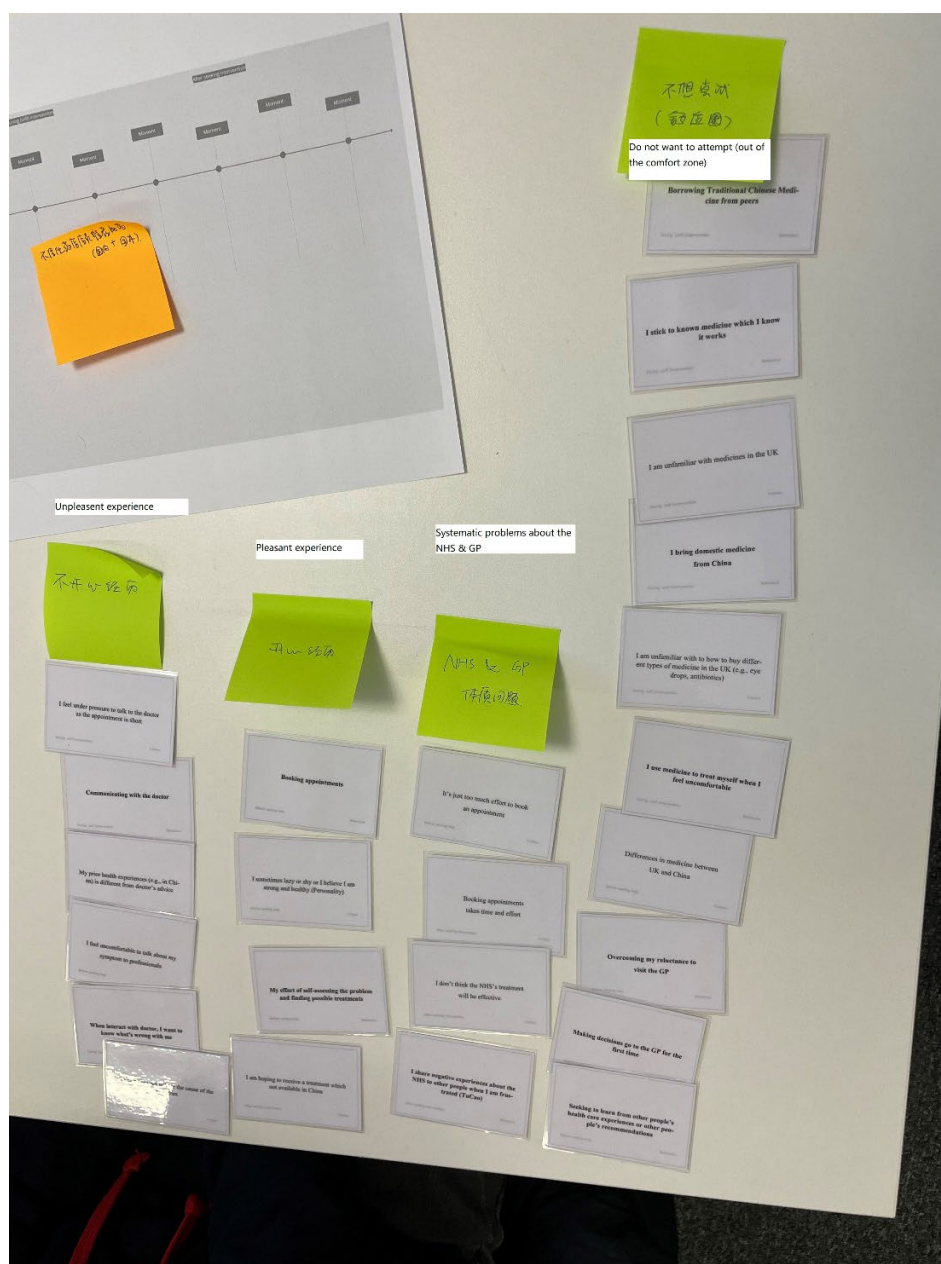


Figure 6.4 An example of the experiencing grouping activity. The participant grouped her experience segments based on emotions, feelings and perceived difficulties.

#### 6.2.3.4 Storyboarding

In the storyboarding activity, the participant is first given an example (Figure 6.5) to illustrate what a storyboard for chatbot design looks like. Then, the facilitator asks the participant to: 1. choose a group of experiences which they particularly want to

address, 2. explain the reason for the choice and what are the problems and difficulties in the current situation that they picked, 3. describe what the ideal situation looks like, 4. think about how a chatbot can be used to help to improve the current situation. After answering the facilitator's questions verbally, the participant will have a clear idea about the chatbot's use case and design requirements. The final step is to draw the chatbot use case scenario onto the storyboard, visualising the answers that they have come up with. Based on the storyboard's use case scenario, the participant is asked to write down a sample dialogue between the chatbot and the user. We do this to get a grasp of what the actual design looks like. At the end of this exercise, the participant has a filled storyboard and a sample dialogue that documents the envisioned chatbot design. An example of the storyboard and a sample dialogue is shown in Figure 6.5 and Figure 6.6. This activity is designed to explore design ideas and discover design opportunities. It answers RQ2.3, "What are the design opportunities for a chatbot to be used to support them, as envisaged by Chinese overseas students?".



Figure 6.5 An example of the storyboard. The participant illustrates a use case for the chatbot to introduce treatment options to the patient.

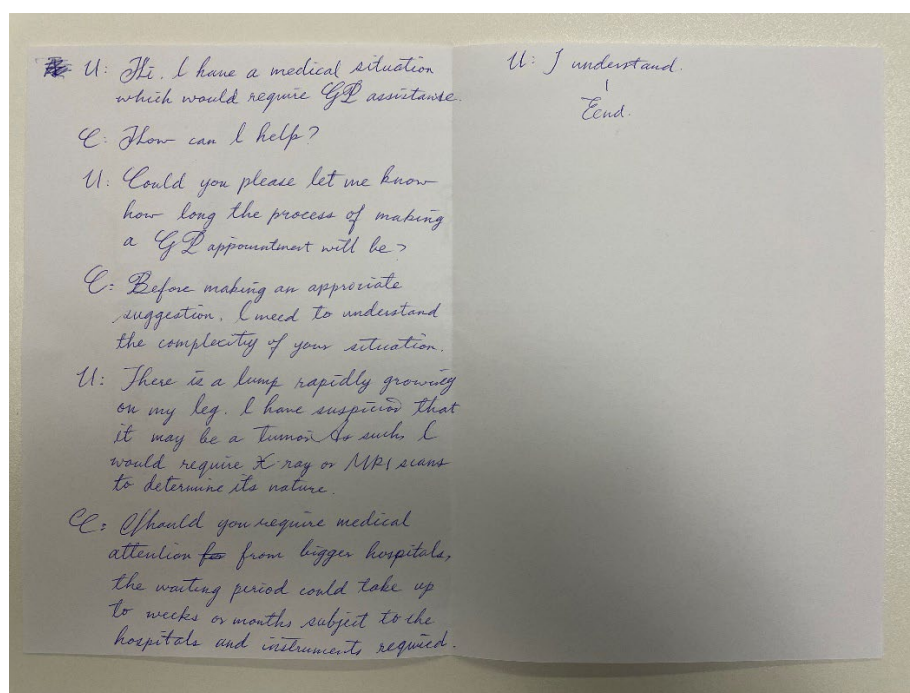


Figure 6.6 An example of the designed chatbot dialogue. The participant illustrates an interaction for pre-assessment.

### 6.2.3.5 Role-playing

Finally, the facilitator and the participants test the chatbot design by role-playing. The use case is simulated according to the storyboard, where the facilitator pretends to be the user, and the participant pretends to be the chatbot to go through the dialogue content. After the role-play, the facilitator asks the participant to reflect on their design. The facilitator asks the participant to highlight any additional changes to be made, including changes in features, in the context of use, and dialogue content. The purpose of this step is to test if the proposed design is applicable and make refinements to the design requirements if needed.

### 6.2.4 Research context and participant recruitment

The co-design workshop was conducted between December 2021 and February 2022 at the University of Edinburgh. The study was conducted during the COVID pandemic. Due to the University of Edinburgh's hygiene and hygiene requirements, we only invite one student at a time to participate in co-design activities. Similar to the grounded theory study, we recruited students from the University of Edinburgh due to the popularity and ease of access of Chinese overseas students. As a result, this study



focuses on Chinese students' healthcare service engagement experience under Scotland's healthcare system.

Participants were selected using purposive sampling, with the following inclusion criteria: 1. Chinese students who are studying or have studied in UK higher education institutes. 2. They have at least one healthcare service engagement experience during their study. 3. They are willing to design chatbots to improve Chinese students' engagement experiences with healthcare services. This time, we eased the criteria by removing the 6-month living in the UK restriction because criterion 2 is sufficient to meet our study aim. They do not have to be familiar with the UK society in order to use healthcare services. We recruited participants in two ways: advertising through the University's email lists and posting via social media platforms (e.g., WeChat groups and University Microsoft Teams channels). Participants were recruited voluntarily. No compelling words were used in recruitment posters.

The workshops took place in quiet, pre-booked meeting rooms and were conducted in a 1-to-1, face-to-face format. Before the start of the workshop, participants were informed about the study's aim, data collection methods and ways of analysing the data. Since healthcare experiences can sometimes be sensitive, they were informed that they can skip activities and refuse to answer questions that make them feel uncomfortable. They were also reminded that they had the right to cease to participate whenever they wanted. Participants were asked to give informed consent before the start of the workshop. The workshop was audio-recorded throughout the process, with photos taken to record the result of the journey mapping and storyboarding activity. They received a £10 Amazon voucher for compensation after the completion of the workshop. Workshops lasted approximately 60 minutes. Workshop conversations were conducted in Mandarin to facilitate communication, although students were free to use any language to conduct the design activities. During the transcription process, sensitive information such as names, subject areas, and locations was removed and replaced by pseudonyms. Since the second coder for the qualitative analysis does not speak Mandarin, raw transcriptions were translated into English by using Microsoft Word's built-in translation function. During the analysis, coders used the original Mandarin transcripts to disambiguate interpretations.

We recruited 8 participants for this study. The participants consist of 2 male participants, 5 female participants and 1 transgender participant. All participants were aged between 23 to 28 years old. 6 of them were master's students and 2 of them were PhD students by the time of participation. Participants studied in subject areas including design, history of arts, computer science, and architecture, with CEFR English proficiency ranging from B2 to C1, i.e., all of them are able to communicate in fluent English in academic and daily settings. Participants have stayed in the UK, ranging from 4 months to 10 years. We classified students into 3 groups. We define Chinese students who have been in the UK for less than or equal to 6 months as new students, as they

are in their first academic semester in the UK. We define students who have been in the UK between 1 year and 3.5 years as adapting students, as they are on their way to completing their studies. We define students who have lived in the UK for 3.5 years or above as acculturated students, as they may have completed a program in the UK, or have lived in the UK for many years before becoming a student. Details of participants' demographic information are listed below (Table 6.1).

Table 6.1 Demographic information of all students who participated in the co-design workshop

| Participants | Gender       | Age   | Subject area     | Degree level | English proficiency | Length in the UK | Student group        |
|--------------|--------------|-------|------------------|--------------|---------------------|------------------|----------------------|
| P1           | Male         | 23-24 | Computer science | PhD          | C1                  | 3 years          | Adapting student     |
| P2           | Male         | 27-28 | Design           | Masters      | B2                  | 1.5 years        | Adapting student     |
| P3           | Female       | 23-24 | Design           | Masters      | B2                  | 1.5 years        | Adapting student     |
| P4           | Female       | 23-24 | Design           | Masters      | B2                  | 5 month          | New student          |
| P5           | Female       | 25-26 | Design           | Masters      | B2                  | 4 month          | New student          |
| P6           | Female       | 25-26 | History of Arts  | PhD          | C1                  | 4 years          | Acculturated student |
| P7           | Trans-gender | 23-24 | Computer science | Masters      | B2                  | 6 month          | New student          |
| P8           | Female       | 25-26 | Architecture     | Masters      | C1                  | 10 years         | Acculturated student |

The workshop is a continuation of the grounded theory study, with the main purpose of examining Chinese students' healthcare engagements. This study was approved by the same ethics committee and sponsorship framework as it was in the grounded theory study, i.e., the School of Psychology Ethics Committee at the University of Edinburgh, Reference No. 273-1819/2 and the Academic and Clinical Central Office for Research and Development (ACCORD) framework.

### 6.3 Data analysis

Two types of data were collected from the workshop: the photos that were taken from the design activities (photos taken from journey mapping, experience grouping and storyboarding, and referred to as "design activity materials" in subsequent sections) and audio transcripts that were recorded during the entire workshop session

(including all 4 design activities). The formal data analysis took place after we completed all 8 workshops (the “End” state of Figure 6.2). We used content analysis to analyse design materials, and we used thematic analysis to analyse audio transcriptions. These analytic processes are illustrated in Figures 6.7 and 6.8 respectively.

### 6.3.1 Content analysis of design materials

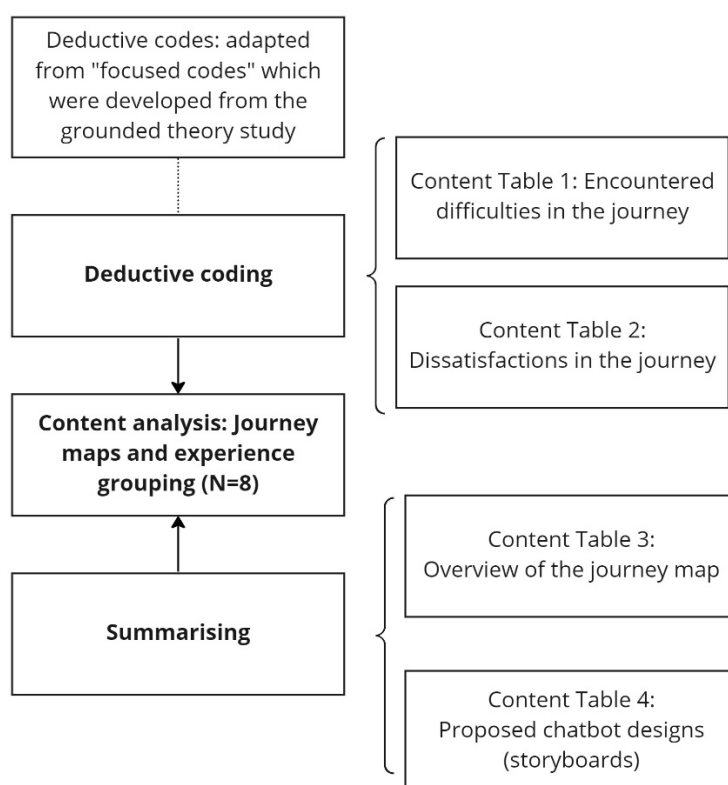


Figure 6.7 The content analysis process of design materials. This includes 2 parts: 1. summaries of journey maps, experience grouping and storyboards, and 2. deductive coding of journey maps and storyboards. The deductive codes are adapted from the focused codes that we developed in Chapter 5 (Appendix B3), with a focus on difficulties and dissatisfaction in healthcare service utilisation.

We carried out the content analysis to summarise and annotate key content in design materials. Content analysis is an analytic process to simplify document data into content categories, thus reducing the complexity of the data (Krippendorff, 2019; Stemler, 2001). Since design materials contain rich data, we would like to make them more analysable by examining patterns in these design materials.

We took a subset of the focused codes, which were developed from the grounded theory study, to build the deductive codebook to annotate the design materials. This



is because students' "healthcare engagement experience" is a subset of students' "healthcare management experience" that we have already investigated in the grounded theory study. Re-using these analytic codes allows us to save time and effort and avoid building the same thing from scratch. Since the focus of the workshop is on discovering pain points in healthcare service utilisation (RQ2.2 "What are the pain points in these healthcare journeys?"), We choose to reuse some of the secondary-level focused codes under the "Perceived difficulties" and the "Attitude towards UK healthcare services" categories and adapt them to be more context-specific.

The actual coding was carried out by me due to the unavailability of the second coder. The content-coding is a top-down coding process. I went through the journey mapping and experience grouping photos of each participant, and made a code annotation if an experience segment matched a code description in the codebook. After coding design materials, I looked back at the journey mapping and storyboarding photos and summarised them into a list of key points. The coding and summarisation are conducted using Microsoft Word software. The outcomes of the content analysis are tables that summarise key points about students' difficulties, dissatisfactions and envisions of chatbot designs with associated frequencies (Table 6.4, 6.5 & 6.6). Since this process was only a simple classification process with a small set of categories, the unavailability of the second coder would not have much impact on the reliability.

### 6.3.2 Thematic analysis of audio transcriptions

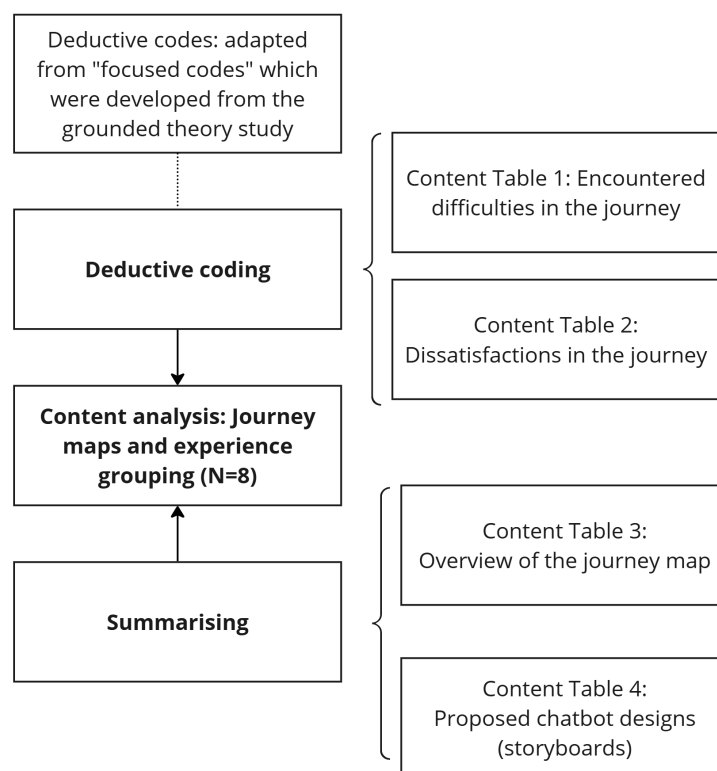


Figure 6.8 The thematic analysis process of audio transcripts. There are 3 overarching themes: Themes 1 and 2 used codes adapted from the focused codes that we developed in Chapter 5 (Appendix B3), with a focus on difficulties and dissatisfaction in healthcare service utilisation. For theme 3, we used open coding to code students' design requirements for chatbot designs.

We carried out the thematic analysis for workshop transcripts. Thematic analysis is a commonly used method to identify and interpret patterns in the data (Kiger & Varpio, 2020). Different from the content analysis method, thematic analysis involves the active interpretation of participants' statements and thus generates meaningful themes.

Similar to the analysis of design materials, we reused analytic codes which we developed from the grounded theory study to save time and effort. This time, we chose to reuse the secondary-level focused codes under the "Perceive difficulties", the "Attitude towards UK healthcare services" and the "Post-decision behaviours" categories to inspire participants and adapt them to be more context-specific. Table 6.2 provides an example of adapted codes which were used in the thematic analysis.

Table 6.2 A section of deductive codes used in the thematic analysis of transcripts. Codes are adapted from secondary-level focused codes from the grounded theory study to be more context-specific (c.f. Appendix C5).

| Deductive Codes                                     | Description                                                                                                     | Example                                                                                              | Adapted from                                                        |
|-----------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|
| Stressors for blocking engagement                   | Obstacles that affect students' decision to seek professional help.                                             | The student has a lot of academic work to do, so they prioritise it over addressing health problems. | Practical reasons                                                   |
| Attribution of responsibility                       | Students feel that it is the doctor's or NHS staff's role to get them recovered.                                | Students just followed the doctor's advice and did not explicitly express their needs.               | Sociocultural matters: positionalities between doctors and patients |
| Specialist vs Generalist                            | Students have a wrong expectation of what the GP can do.                                                        | The student expects to have specialised examinations but is refused by the GP.                       | Personal beliefs: high expectations from the GP                     |
| Problems in administration registration and booking | Students encounter issues that relate to NHS administration, GP registration, and booking medical appointments. | The student has to spend a lot of time looking for a GP that accepts new patients.                   | Organisational disorientation                                       |

For the thematic coding, we used both deductive and inductive coding. If a participant's statement matches one of the descriptions in the codebook, we code that statement into the corresponding code. If we identified something new that did not match any descriptions in the code, we added a new code with a description in the codebook that describes the statement. We incorporate inductive coding because we expect to discover new themes. The workshops also include topics on identifying design opportunities and proposing chatbot design requirements. These topics were not covered in the grounded theory study. We imported all transcripts into the NVivo software (release 1.7, QSR International) for the thematic coding. The coding process was undertaken by me and another researcher who has qualitative coding experience. We coded transcripts one by one concurrently. For each transcript, we first familiarise ourselves with it and look back at the corresponding photos to understand the context. Then, we coded the transcript line by line separately according to the codebook. After that, we went through the transcript line by line again to discuss what code we had assigned to each sentence. We referred back to the original Mandarin transcript to clarify interpretations when we had disagreements. If a new code emerged, we added the new code to the codebook if both of us agreed that it was suitable for the sentence. Having a second coder allows me to reduce bias when

interpreting participants' statements. The outcome of the thematic analysis contains 3 broad themes: the difficulties and dissatisfactions in healthcare journeys, the behaviours for coping with problems, and the proposed chatbot use cases. The outcomes of the thematic analysis are described in Section 6.4.

## 6.4 Results

In this section, we split the results into 2 parts. Part 1 describes participants' difficulties in and dissatisfactions with healthcare service engagements. This part answers RQ2.1 and RQ2.2, "What kind of healthcare journeys that Chinese overseas students experienced?" and "What are the pain points in these healthcare journeys?" Part 2 describes the requirements for chatbots envisioned by participants. This part answers RQ2.3 "What are the design opportunities for a chatbot to be used to support them, as envisaged by Chinese overseas students?" We will present the results from the content analysis and thematic analysis together because these results are aligned with each other. In the content analysis, we counted the frequency of difficulties, dissatisfactions, as well as types of chatbot design mentioned by participants. The difficulties, dissatisfactions, and chatbot features aligned with the 3 overarching genres in the thematic analysis, the problems in healthcare journeys, dissatisfactions in healthcare journeys, and types of chatbot features designed by participants.

### Part 1: Design Opportunities

Participants described a range of healthcare journeys. They encountered various difficulties, and they felt unhappy in their journeys.

#### 6.4.1 Summary of Healthcare Journeys

This section answers RQ2.1, "What kind of healthcare journeys that Chinese overseas students experienced?". This section describes the types of healthcare encounters by Chinese overseas students. Overall, we identified 4 kinds of healthcare engagement contexts, including dealing with administrative matters and resolving minor, chronic, and urgent health problems. The summary of participants' health journeys is shown in Table 6.3.

Table 6.3 Summarisation of participants' engagement journeys with healthcare services in the UK.

| Participants | Contexts of engagement                                                                                                                                                                                                                    |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| P1           | Having rash, not experienced before (visit the GP)<br>2 fingers feel paralysed, not experienced before (visit the GP)                                                                                                                     |
| P2           | COVID vaccination and vaccination passports between NHS England and Scotland                                                                                                                                                              |
| P3           | Bruised toenail, never experienced before (visited the GP), GP carried out simple examinations and told her to do nothing<br>Do not trust the pharmacist                                                                                  |
| P4           | Register with a GP (first come to the UK)<br>Obtaining vaccination passports<br>Not familiar with UK medication                                                                                                                           |
| P5           | Register with a GP (first come to the UK)<br>Obtaining vaccination passports<br>First time using the GP, and was referred to the urgent care unit                                                                                         |
| P6           | Bad cold and fever (visit the GP)<br>Problem with the urine system (visit the urgent care unit)<br>Confused about the role of GPs and pharmacists                                                                                         |
| P7           | Booking an appointment with the GP (under COVID regulations)<br>Transgender needs: want to receive Hormone Replacement Therapy (HRT), but do not know what to do and who to contact (and argue with them)                                 |
| P8           | Suspicious of bone cancer symptoms, asked the GP for further examination (articulation of the problem and avoiding long waiting time)<br>Need to arrange an urgent surgery<br>How to receive cancer treatment (chronic illness) in the UK |

Students access healthcare services with different motivations. One reason is that they were told to register with the GP to receive any healthcare services in the UK. As new students, P4 and P5 reported their journeys to register with a GP that accepts new patients. Another common reason is that participants were experiencing minor, yet annoying illnesses, so they decided to visit the GP or pharmacy to seek help. P1, P3, and P6 reported their journeys either going to see doctors or pharmacists for consultation since they were experiencing illnesses such as rash, suspected symptoms of bruised toenails and severe cold. Specifically, P1 and P3 visited the GP because they experienced illnesses that they had never experienced before. P2 contacted the GP, NHS England and NHS Scotland several times to obtain the vaccination passport during COVID times, as he lives in Scotland but was vaccinated in England. P7 and P8 were planning to contact the GP as they wanted to continue treatment of their existing condition in the UK. As a transgender person, P7 wanted to receive Hormone Replacement Therapy (HRT) in the UK, as she is running out of medication. P8 wanted to continue her bone cancer treatment (follow-up checks) in the UK. She initially had suspected symptoms of bone cancer; however, the urgent care unit and the GP refused to arrange further actions, so she went back to China for the operation. To conclude,

participants engage with healthcare services in the following scenarios: resolving administrative problems, experiencing minor illnesses, having urgent conditions or under emergency, and continuing treatment for chronic illnesses.

#### 6.4.2 Difficulties in Healthcare Journeys

This genre aims to answer RQ2.2, “What are the pain points in these healthcare journeys?”. This genre describes problems that participants encountered during their visits to healthcare services. All Participants encountered at least one difficulty in their engagement with the healthcare service. Overall, we identified 13 types of difficulties in their journeys. The content analysis results are shown in Table 6.4.

Table 6.4 Types of difficulties that participants have encountered in their journeys. The table includes the type of difficulty encountered by participants, descriptions of the difficulty, and the number of participants mentioned in the journey map.

| Type of difficulties                           | Description                                                                                                 | Frequency (# of people mentioned)     |
|------------------------------------------------|-------------------------------------------------------------------------------------------------------------|---------------------------------------|
| Medication problem                             | Participants were not familiar with UK medications and ways to access them                                  | P1M, P3F, P4F, P5F, P6F, P7X, P8F (7) |
| Communication problem (language)               | Participants were worried about running into language problems when interacting with doctors.               | P1M, P3F, P4F, P5F, P6F, P7X, P8F (7) |
| Consultation problem                           | Participants found it hard to articulate their symptoms and needs                                           | P1M, P3F, P4F, P5F, P6F, P8F (6)      |
| Emergency problem                              | Participants did not know if, and what to do in urgent situations or emergencies                            | P1M, P4F, P5F, P6F, P8F (5)           |
| Booking appointment                            | Problems in arranging appointments with healthcare services, usually GPs                                    | P3F, P4F, P6F, P7X, P8F (5)           |
| Hard to make sense of the UK healthcare system | Participants found it hard to make sense of the UK healthcare system and how they work together             | P4F, P5F, P6F, P7X, P8F (5)           |
| Searching online (time and effort)             | Problems in searching healthcare information online                                                         | P2M, P3F, P6F, P7X, P8F (5)           |
| GP registration (hard to find one)             | Problems in registering with a GP, usually participants found it hard to find one that accepts new patients | P3F, P4F, P5F (3)                     |

|                                              |                                                                                                               |                   |
|----------------------------------------------|---------------------------------------------------------------------------------------------------------------|-------------------|
| Belief problems (not trusting professionals) | Participants distrust healthcare professionals in the UK, feeling that they are incompetent or unprofessional | P1M, P3F, P4F (3) |
| Emotional reluctance                         | Participants are emotionally reluctant to seek professional help                                              | P3F, P4F (2)      |
| Transportation problem                       | Participants lived far away to visit healthcare services                                                      | P4F, P5F (2)      |
| Conflict resolving                           | Participants found it difficult to carry out negotiations and persuade the doctor to fulfil their needs       | P2M, P8F (2)      |
| Administrative problem                       | Problems in NHS administrations, such as obtaining health records                                             | P2M (1)           |

The medication problem is the difficulty that has been mentioned by most participants (7 people). Communication problems are another type of difficulty that has been mentioned by the same number of participants. Then followed by the consultation problem (6 people), the emergency problem (5 people), the appointment booking problem (5 people), the difficulty in understanding the UK healthcare system (5 people), and the problem of searching for medical information online (5 people). Three people mentioned the difficulty of registering with GPs, and the same number of people did not trust UK healthcare professionals. Two people have mentioned the difficulty of negotiating with doctors about examinations and treatment options (i.e., resolving conflicts). Another two people have mentioned that they are emotionally reluctant to seek professional help (i.e., emotional reluctance). In addition, two participants mentioned that they lived far away to visit healthcare services (i.e., transportation problems). Only one person mentioned that he had encountered an administrative problem in obtaining a COVID-19 vaccination passport. The results from the thematic analysis of healthcare visiting difficulties are described in the following subsections.

#### 6.4.2.1 Problems in GP registration and dilemmas in administration

Some participants reported that they had a hard time registering with a GP. New students found it particularly difficult to find a GP who takes new patients. P5 described her registration experience as a “bumpy” experience.

I have now registered with a GP eventually, but I haven't seen a doctor yet. The process of registration was quite bumpy for me. When I first arrived in the UK, I did not know that the GP could be full. I also thought

that I might not need it, so I did not register for the GP (at that time). I was wrong. Most GPs were full when I was planning to register with it (2 months later). (P5, 4)

Based on her friend's recommendation, P5 eventually found a GP that still accepts new patients; however, the GP used a "first-come, first-served" policy, which means she has to get up in the early morning to "compete" with others.

(Her roommate and she) We arrived at 6:30 am, but there were already 4 people waiting. We wondered why the registration was so competitive. Then, we decided to come back the next day. We arrived at 6:30 am again the next day. When we got there, another 4 people were queuing in front of the door. I was too eager to get the vaccination passport, so, on the next day, we arrived at 4:30 am. However, when we got there, another 4 people were queuing in front of the door. They told me that they arrived at 4:00 am. One guy told me that you need to I We eventually got it registered, in early December, when I stayed up late to submit coursework. After the submission, I rushed over to the GP. It was around 4-5 am. (P5, 4, 47)

P4 also encountered the same problem. She tried to register with a GP desperately, both online and in person. She went to different GPs, and refreshed GPs' websites many times but had no luck. She even suspected that the GPs' websites were fake as they were always full (P4, 10). P3 stated that she asked others to write an automated script which searches for empty spots to get her registered (P3, 63). However, a friend of P5 did not get registered. This is because she was not aware of the "area restrictions". She went to the GP who was far from where she lives, and she did not know which area was her "local area" (P5, 14).

Apart from GP registration, participants also experienced dilemmas in administration. As a transgender person, P7 wanted to start her Hormone Replacement Therapy (HRT) in the UK. The first step is to ask the GP to refer her to the specialist for transgender checks. However, during COVID times, the GP requested her to test negative in the PCR test before coming to the practice. On the other hand, NHS requires the patient to reveal COVID symptoms before booking PCR tests. She did not have COVID symptoms at that time, so she could not book an appointment with the GP. As her medication was about to run out, she did not know what to do.

If I book a PCR test, they (NHS) won't allow me to do so as I don't have COVID. You have to have symptoms to book a PCR test, and I need the test result to see the GP and ask them for the transgender check referrals. It becomes a dead loop as I don't have COVID. (P7, 36-42)



P2 has a difficult time obtaining the vaccination passport during COVID times. He was vaccinated in England and wanted to get his vaccination passport in Scotland for his international travel. However, the GP, NHS Scotland and NHS England use different systems and have different policies regarding issuing vaccination passports. He first called NHS England, and they told him that they had already transferred his record to NHS Scotland. NHS Scotland said that they did not receive any documents and told him to ask the GP to upload the certificate from NHS England. The GP said that they were not allowed to do so. Eventually, he had to cancel his trip.

They seem to disagree with each other. It's like... I can submit the certificate (vaccination record), but they just don't allow me to do so. It's like an internal "fight". And...I have noticed that there's also a keyword that keeps popping up in the journey map activity constantly, which is 'waiting'. I don't know how they process it and how long it will take. [emphasis] (P2, 177)

It requires me to contact different departments and individuals. This is challenging for me because the situation is very complex, and I need to describe my issue over and over again. Every time I contact a different person, I have to describe my problem again. (P2, 183)

#### 6.4.2.2 Unfamiliar with the NHS

Another difficulty is that participants did not know how NHS works and how it is different from the hospital-centralised Chinese system. As a new student, P4 vaguely know that the NHS has something to do with healthcare.

I don't know what the NHS is exactly. Maybe I roughly know that it's related to healthcare, but I don't have a clear understanding of it. I know that I have to register with a GP, but I'm not quite sure about the differences between the Chinese and the UK healthcare system, and nobody explained it to me. (P4, 10)

P6 did not know how different NHS departments are interconnected with each other. She was confused about the role of each department and the way to contact the right department.

I feel that the biggest difficulty for me is to make sense of the role of different departments, like pharmacies, GPs, and hospitals, and how they are connected. There is no such information about this online. I once assumed that they work separately, but in reality, they work collaboratively. I went to the hospital at night once, and the GP called

me to confirm my situation the next day. I suspect that the GP and the hospital are somehow connected. However, there is no official information online that explains this. (P6, 82)

P3 did not know how to obtain prescriptions. After the GP consultation, she got the prescription letter but did not know where to get the medication.

“Does the pharmacy here (in the UK) have a doctor? Can I ask them what I should buy? I had no idea about this process. At that time, the doctor from the GP had just given me a (prescription) letter and I was a bit confused (about how to obtain the medication). I felt like “Is that it?” Why did the consultation end quickly? (P3, 165)

P6 worried about not knowing what to do and what the treatment process looks like in urgent conditions or emergencies. She claimed that “the most difficult part for me is to understand the relation between the pharmacy, GP and hospital. How they collaborate? (P6, 82)”. She wanted to book a respiratory-specialised doctor in the hospital, but realised that the UK system works differently. You have to contact the GP first (P6, 22). She further explained “I worried that in the most urgent situation, I won't be able to find the most suitable way to deal with it. This might waste a lot of time, money, and effort (P6, 84).” P8 is aware that the NHS has different sub-systems for different things, which differ from the hospital-centralised system. She wanted NHS could make it clear on its website.

The NHS system has different sub-systems. For example, different hospitals have different equipment. If I want to know where I can take an X-ray, I should be able to look up the NHS website and thus know how to arrange it and where to go. (P8, 140)

#### 6.4.2.3 Problems in urgent and emergency conditions

Participants felt that it was particularly challenging when they experienced urgent conditions. The first problem is that it is hard to distinguish whether the condition is urgent or not, and, if it is urgent, what to do. P1 had a rash all over his body, which made him a bit worried. He felt that it was a relatively urgent condition, but at the same time, he felt it was not severe enough to call 999 (life-threatening). He queued for the GP in the end.

They told me that I would be seen 2 days after the booking. However, I think having a rash that is all over my body is a relatively urgent condition. At that time, I didn't know 111 and I thought it was not severe enough to call 999. I thought that I could only go to the GP. So I

went to the GP, and they made an appointment and told me to come back two days later. The rash had gone down quite a bit within these 2 days, so it was a bit awkward when I met the doctor. (P1, 10, 60-63)

The second problem is about seeking others for help in urgent conditions. P6 had an acute problem with the urine system during the night. Since she lives alone, she had to bear the pain and wait until the GP opened.

I didn't know what happened, but I knew it was a very serious problem. I had never had this problem before. I lived in a studio alone, and I was doing a research program, so I didn't even have close friends. I couldn't even find local classmates for help because I didn't know anyone. So I kept searching online, even for ambulance services, because I was very uncomfortable at that time. I only slept 2-3 hours that night. (P6, 6)

The third problem is that participants are concerned about treatment delays under urgent conditions. P1 had an acute rash and was seen by the GP when he was about to fully recover. He said that "it did not help much at that point. It turned out that it is not a serious thing." However, he added, "I did not know how severe it would be. If it turns out to be serious, it (the delay) would result in some serious consequences (P1, 59)." P5 had the same thought after she noticed her friend had run into an urgent problem and was seen by the GP quickly.

This has troubled me a lot. The queuing time. If I have something urgent, I don't know whether my GP will allow me to cut in line, like what my friend did and see the doctor immediately. I am worried about this if it is a real emergency (P5, 81)

Following this, P8 had a difficult time persuading the doctor to gain immediate attention to her urgent problem. She had developed an acute tumour near the joint of her leg, which is a typical symptom of bone cancer. At that time, she was told by her roommate's mother, who is a doctor in China, that she might have bone cancer. She suggested that P8 be examined as soon as possible. However, the GP disagrees with it. They felt that it may not be an urgent problem and told her to wait to be examined. In the end, she went back to China and had the operation there.

I said a lot to her on that day, I told her that it may be a sign of cancer. She replied that she did not feel that serious, but she would listen to me. Then she arranged a CT scan for me, but told me that I had to wait, and she did not know how long I had to wait. (P8, 37, 43)

Thankfully, my roommate bought me a plane ticket that night, and I flew back to China. I was diagnosed with bone cancer the next day, and I had the operation within a week. Amputation and chemotherapy. (P8, 53)

#### 6.4.2.4 Problems in chronic treatments

Participants with chronic problems found it difficult to resume their treatment in the UK. As a transgender, P7 found it hard to resume HRT in the UK as she had to go to the GP and obtain their approval to go to see specialists and pass the “transgender” examination. After the amputation and a few cycles of chemotherapy treatment, P8 went back to the UK to continue her studies. The doctor in China asked her to do follow-up checks in the UK, and conduct X-ray and CT scans every 3 months. After she arrived in the UK, she phoned her GP immediately to arrange follow-up checks for her. This time, the GP agreed to follow-up checks for her. However, this process was interrupted by COVID.

Four months later, I received a letter saying that I could go to [address] to have the X-ray and CT scan. They told me that I am a regular patient, so they would reschedule me to have the check every three months. However, this process was interrupted by COVID. The hospital and the GP were all closed. I called the GP and wanted to resume the check, but they were not answering, and they closed their reception as well. It has been 2 years now; I have received no letter to resume follow-up checks. (P8, 75, 83, 93)

#### 6.4.2.5 Problems in Minor Conditions

GP is the first place of contact when people have minor conditions. Participants reported that they have difficulties booking timely appointments with the GP. P4 was “intimidated” after hearing about her friend’s experience.

One of my classmates got sick and booked an appointment, but the GP was very busy that week and couldn't make the appointment until late next week. She bore the pain for days, and by the time of booking, she had already recovered. So, their (NHS) efficiency is a bit worrying me. They won't be able to meet my needs. It is just too slow to get an appointment. (P4, 86)

P6 also encountered delays in appointments. After visiting the GP for the first time, she was aware that the waiting time depends on the severity of the illness; therefore, she came up with a tactic of requesting quick appointments.

I had a severe cold once, but didn't get a fever. This was the first time I made an appointment. I was expecting that I could see the doctor within a week after the booking. However, they arranged it two weeks later. By then, I had almost recovered. Since then, I booked the appointment "wisely". When booking appointments, when the symptom starts to develop, I exaggerate my condition, like five or six times, seriously. As a result, I always see the doctor within that week. (P6, 6)

The language problem is another difficulty that was reported by many participants. P4 was reluctant to seek the GP's help as she worried about the language barrier when interacting with the doctor (P4, 78). P5 specified her worries regarding this barrier: "I may not be able to describe the symptom precisely. I may not know how the doctor would respond. I may not understand the doctor's advice. (P5, 190-195)." Similarly, P3 reported, "I am worried that I cannot describe clearly in English what kind of illness I have (P3, 123)." "Even after symptom description, I am also afraid that the doctor will ask me follow-up questions that I might not be able to understand (P3, 125)." P4 feels that the GP might not be useful as "They may have given me a lot of professional advice, but because of the use of certain professional terminology or their expressions, I may only partially understand what they were saying (P4, 80)". In addition, P6 mentioned that she was afraid to communicate in general and had a hard time recognising the accent when she was a new student. "I just arrived in the UK and don't know how to express myself. I'm also afraid that I won't be able to understand accents here. I'm afraid of making mistakes and causing trouble to others (P6, 28)". P2 concluded that articulating symptoms to the GP is indeed challenging.

Communicating complex issues using a second language is indeed challenging for us. In this case, there may be many technical terms involved, and it requires us to describe a lot in a precise way. We may worry that we won't be able to express ourselves accurately in English and thus cause trouble (misdiagnosis), so that's why I always prepare beforehand about what I want to say. (P2, 165,183)

Participants also run into problems that relate to the GP consultation. First, students may not be aware of the treatment options available. P3 preferred to see a female doctor but was assigned to a male doctor, as she was not aware of the option to register with a specific doctor in the GP.

When I was registering with the GP, they gave me a booklet with a list of doctors' names, but they did not give specific details about these doctors or instructions on which doctor to choose. I called them and they asked if I had a preference. I did not know these doctors, so they randomly assigned one for me. The doctor that I was assigned to is a

man. This makes me feel a bit uncomfortable. If I had a choice, I would have preferred a female doctor because it would be less embarrassing sex when doing physical examinations. (P3, 36, 40)

Second, participants were concerned about ways to argue if they disagreed with the doctor. P4 expressed her worries, "Sometimes you know what you got, and you know that you want A, B, C. I worry that sometimes the doctor does not give you what you want. For example, how to persuade the doctor that you need antibiotics (P4, 115)." P8 had a difficult time arguing with the GP to conduct examinations for her as soon as possible, as she had the symptoms of bone cancer.

At first, the doctor wasn't sure what it was. He wasn't sure if it was a muscle strain or some other serious problem. He advised that I could wait a bit longer and then see how it goes. I disagreed with him, so I switched to another doctor. This time, I was determined, and I asked them to book the examination explicitly. Then, the doctor suggested scheduling a specialist appointment, but I needed to wait. (P8, 13)

To mitigate the problem, P2 prepared his arguments before calling the GP to obtain the vaccination passport.

I came up with two reasons to argue with them. First, my friend succeeded (in obtaining the vaccination passport) with their GP, Why can't you do the same thing? Second, I really need it fast because I need to go abroad. I prepared them in advance and then made the call to argue with him. (P2, 167)

P6 described her symptoms in a serious way to let the doctor pay attention to her needs.

This was the second time, so I knew that the fever was caused by tonsillitis inflammation, so by the time I had a little bit of a sore throat, I told him all the consequent symptoms that I had experienced for the first time. I also mentioned how these symptoms were affecting my daily life. I told them that I was coughing so heavily that I couldn't even go to the library, even though it wasn't true. I exaggerated the severity of my condition, making it seem like I was in the later stages of the illness. Then, they prescribed antibiotics for me. (P6, 60)

Some participants did not trust the health professionals to handle minor problems. They did not ask professionals for help even if they were experiencing discomfort. P3 stated that she did not trust the pharmacist when buying medicines.

I don't know which staff member (in the pharmacy) can help me and give medical advice. Just like buying medicine in China, here, I only buy

medicine that I know is useful. I won't ask the staff directly. I don't trust the pharmacy staff. I did the same thing in China. (P3, 163, 165)

P1 did not trust the GP as he felt under-treated by the GP once. He had an acute rash on his body, and he worried that it could be something serious. Once he arrived at the GP, he was expecting to have some sort of examination, but he was shocked as the doctor asked him, "What do you think you have?" This makes him distrust the GP's skills.

I find this quite hilarious. Because the doctor asked me, "What do you think you have?" If I knew what I had, why would I need to see a doctor? Right? I don't think they took me seriously; this made me think that GPs were not very helpful. I told the new students that the NHS is just like that. If you have problems, you may still have to cope with yourself eventually. (P1, 51, 184-187)

#### 6.4.2.6 Problems in medications

Participants reported that they are not familiar with UK medications. Students may be confused about the names of the medications in the UK, as there are two names commonly used in the UK system: the brand name (given name by pharmaceutical companies) and the generic name (naming by key ingredients). P1 was confused when the pharmacist gave him a medication which differed from the doctor's note. "I was confused because it had a different name compared to the doctor's note, and the pharmacist told me they were the same. Later on, I realised it was probably because of the brand difference (P1, 164)."

Students also do not know which medication to buy because they do not know about the efficacy of UK medications. P5 desperately wanted to find a substitute medication, which she brought from China, as she was running out of it. However, there is no official information like that for her to look up.

I was running out of a kind of medication which I brought from China. I was not registered with a GP at that time, so I didn't know if any medications worked equivalently to the one I brought from China. I used XiaoHongShu (Little Redbook, A Chinese experience-sharing app) to search for people who have the same experience so that I could learn from them. I didn't know of any official sources to look for this kind of information. (P5, 131, 134)

P8 ran into a problem where the medicine that she was taking had not yet been approved in the UK.

That medication is only available in China. In the UK, I asked them if they could prescribe it, and the doctor looked at the name of the medication and said that this medication hadn't been approved yet by the MHRA (Medicines & Healthcare Products Regulatory Agency), so they couldn't prescribe it to me. (P8, 113)

Some participants did not know ways to access medications in the UK. For prescribed medications, P4 asked, "I'm not very familiar with this system. I assume that the doctor will give you a prescription, and then you can buy the medicine yourself at a pharmacy. Is that correct? (P4, 102)" P3 never asked the pharmacist to buy medications. "I have never tried to ask the pharmacist to buy a specific medication. I just picked up eyedrops from the shelves. Actually, I don't know how to find the medication I want to buy (P3, 143)."

In addition, students may also be confused about the cost of the medication, as in Scotland, people are free for prescribed medications, but not for non-prescribed ones. P1 thought that he did not need to pay, but was called by the pharmacist because what he brought from the doctor was just a note, not the prescription form. "It's a bit funny. The GP gave me a note, not the prescription, and let me buy it (P1, 54)."

#### 6.4.2.7 Problems in online searching

Participants reported that they searched for information online to understand symptoms and treatment procedures. P6 uses Google to search for the English name of the symptom to make sense of the illness (P6, 18). P2 uses the XiaoHongShu app to search for other people's COVID vaccination experiences (P2, 52). However, searching takes a lot of effort from them. P5 said that "finding useful information on English websites can be challenging for non-native speakers, as you have to read through all materials one by one (P5, 107)." Sometimes, online information may be confusing. P1 feels online information is unreliable. "(When understanding my symptoms), online information says different things, and it is hard for me to conclude. It can be rush, or it can be something else; there are many possibilities (P1, 135)." P2 attribute this problem to the inadequacy of official information.

I spend a lot of time looking for information about taking the vaccination in England while living in Scotland. I think the problem is that there is insufficient information from official sources. I was unsure if I was allowed to get vaccinated in England and transfer my vaccination record to Scotland. It seems that I cannot find detailed information about it through official channels. I can only obtain this information by reading other people's shared experiences. (P2, 173)



P5 hoped there could be an official source about medication, particularly information on finding medicines that are equivalent to those sold in China. “Right now, I have to spend a lot of time reading through the XiaoHongShu, it would be a lot easier if they (NHS) provided me with a simple answer (P5, 131).”

### 6.4.3 Dissatisfactions in Healthcare Journeys

This genre complements Section 6.4.2, which aims to answer RQ2.2, “What are the pain points in these healthcare journeys?”. This genre describes the dissatisfactions (i.e., unpleasant feelings). Overall, we identified 9 types of dissatisfaction in healthcare journeys. The content analysis results are shown in Table 6.5.

Table 6.5 Type of dissatisfaction that participants have mentioned in their journeys. The table includes the type of dissatisfaction encountered by participants, descriptions of the type of dissatisfaction, and the number of participants mentioned in the journey map.

| Type of dissatisfactions                                      | Description                                                                                                                                     | Frequency (# of people mentioned)          |
|---------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|
| Not being valued or below expectations                        | Participants were concerned that doctors would not treat them seriously, or that they receive treatments that did not fulfil their expectations | P1M, P2M, P3F, P4F, P5F, P6F, P7X, P8F (8) |
| Demanding effort (to receive treatments)                      | Participants felt that they needed to spend a lot of time and effort to receive treatments                                                      | P1M, P3F, P4F, P5F, P6F, P7X, P8F (7)      |
| Feels uncertain about processes                               | Participants felt uncertain about what treatment processes look like, and what to expect them to do                                             | P2M, P3F, P4F, P5F, P6F, P7X, P8F (7)      |
| Negative impressions                                          | Participants think that NHS services are ineffective inefficient and useless in resolving health issues                                         | P1M, P2M , P3F, P5F, P6F, P7X, P8F (7)     |
| No timely response                                            | Participants waited for a long time for the NHS to respond to their request                                                                     | P1M, P2M, P5F, P6F, P8F (5)                |
| Diverge from prior experiences in China                       | Participants’ healthcare experience in China did not work in the UK, resulting in unmet needs                                                   | P3F, P4F, P5F, P6F, P8F (5)                |
| Inconsistencies and problems in treatments (irresponsibility) | Participants were confused by inconsistencies in medical advice given by doctors or administrative processes given by NHS staff                 | P2M, P4F, P5F, P8F (4)                     |

|                                          |                                                                                                                           |                    |
|------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|--------------------|
| Sharing negative experiences with others | Participants shared their unpleasant healthcare engagement experiences with others                                        | P1M, P2M , P5F (3) |
| WM being ineffective (prefer TCM)        | NHS does not offer TCM treatments, despite participants feeling that TCM is more effective in treating certain conditions | P1M (1)            |

The most prevalent type of dissatisfaction is “not being valued or below expectations”. All participants shared this type of dissatisfaction to some degree. 7 participants hold a negative impression towards UK healthcare services. An equal number of participants stated that they need to spend a lot of time and effort to receive proper treatments. Many participants (7 of them) also felt uncertain when they went through the treatment process, as they did not know what to expect, what the outcome would be and what to do next. 5 participants have experienced a long wait for NHS to respond (i.e., no timely response). The same number of participants said that their previous healthcare experience, such as treatment processes, in China, did not work in the UK. 4 participants encountered problems of conflicting advice or policies between health professionals or departments, which made them feel that services in the UK are confusing. 3 participants mentioned that they have shared their negative experiences with their friends and colleagues, and 1 participant mentioned the ineffectiveness of Western medications and treatments for certain conditions and the doctors’ incapability of offering TCM treatments. The thematic analysis results of dissatisfaction in healthcare service engagements will be described in the following subsections.

#### 6.4.3.1 Negative impressions and attitudes

Participants generally hold negative impressions towards NHS. P1 stated that he was having unpleasant experiences, not because of language and communication problems, but because of the treatment process.

Overall, my experience using the NHS is not very good. The main reason for the negative experience is due to the process in this system, not communication issues. It's not that I'm afraid to talk to doctors or that I don't know what to say. I know how to express myself. It's more because of the problems in the treatment processes that make my experience less-than-satisfactory. (P1, 3)

Specifically, participants have complained about 2 things: the NHS’s rigid administration and treatment process, and unequal efforts and benefits of visiting

professional services. P2 pointed out that the NHS is bureaucratic when resolving his problem.

There is a common attitude in NHS where they say, 'I understand your situation, but I can't help you.' They usually act like this when they don't want to help. It's like saying, 'I'm not the decision-maker. I'm just a staff member. I can only help with your case based on what I have been taught. This is outside my responsibility; I can't help you.' (P2, 117)

Similarly, P8 distrust NHS because they often make simple mistakes and never correct them. This makes her feel that NHS is unreliable (P8, 63).

Because of many things, you have to fill out forms or something, and they (staff) tell you, 'OK, I'll help you with this.' But I know that they will mess it up. For example, for something as simple as changing my address, they entered the wrong name and address. Then, when I told them to correct it, they said, 'OK, I know.' But they never change it. (P8, 95)

As for the treatment process, P5 described it as being “inefficient” and “user unfriendly”. She had a friend who was accidentally hit on her face, causing tissue fluid to leak and inflammation. Even though she needed urgent treatment, she was asked to wait in the GP's queue. Later on, she was referred to the hospital; however, she had to get there herself.

This process made me dissatisfied because of its inefficiency and unfriendliness. Inefficiency refers to the fact that even in an urgent situation, she still had to queue to see a GP, and the wait time was very long. User-unfriendly refers to the fact that when she needed to be transferred to another hospital, she had to go there by herself, even though she was feeling very uncomfortable and needed assistance. The distance to the other hospital was quite far away, but NHS just asked her to take a taxi. (P5, 55)

Apart from negative impressions, participants felt that they needed to spend a lot of effort to access professional services while receiving limited help from them. P4 described the process of visiting professional services as “demanding”.

If I need to see a doctor, before going, I would have concerns about the scheduling, the distance, and what preparations I need to make. I probably need to overcome some of the anxiety and fear and put in some effort. For example, I would be searching for information online, considering how to interact with the doctor and how to express my concerns. I would also ask my colleagues for some advice. (P4, 151)

In contrast to the time and effort that they need to put in, participants felt that advice from professionals may not always be helpful. P1 described his GP visit experience as “useless”. He “relies on his own” to overcome the discomfort.

I don't find it (going to the GP) very useful. If I don't go through this process, I can still get better on my own. So I have an impression that for most of the discomforts, going to the GP, at least for me, well... it's optional. Because I don't have any major illnesses. For minor illnesses, whether I see a doctor or not doesn't make a difference. Because I'll get better on my own. When I had a cold and a fever, I would not go to the GP again. I feel like if I go, they will ask me to wait anyway. The discomfort will just go away before seeing them. I can take medicine myself. It's like relying on myself. (P1, 76)

#### 6.4.3.2 Prior experiences in China and unmet expectations

Healthcare systems between China and the UK work drastically differently. The Chinese system is hospital-centralised and insurance-based, whereas the UK system is primary service distributed and residence-based. However, participants may not be aware of these differences and assume their prior healthcare experiences in China are still valid in the UK. Chinese people go to hospitals when they feel uncomfortable. Overseas students may treat going to the GP the same as going to the hospital, expecting that the GP will carry out specialised examinations, which is just like what they experienced in Chinese hospitals. However, as generalists, doctors in GPs rarely carry out those tests. Often, students do not get what they expected. This makes Chinese students feel that GPs are unprofessional. P8 concluded that “They were nice but incompetent (P8, 9)”. P1 did not understand why the GP asked him, “What do you think you have? (How do you feel about it)”. He interpreted it as incompetence. “I find it (this question) is quite hilarious. If I knew what I had, why would I need to see a doctor? Right? (P1, 51)”. P3 also challenges the usefulness of the GP.

GP is like a person who knows nothing. If you ask for something, they will give you that thing, and if you don't ask, then there is nothing. I feel like the GP is just like a clinic. They can only help you with minor problems, and the doctor is not an expert. It feels like the GP doctor is a manager. For the diagnosis, they only asked simple questions and never gave me any examinations, and they never told me what was going on with my condition exactly (P3, 167).

P5 expected the GP to introduce more quantifiable criteria for diagnosis (This is the common Chinese hospital approach) as this makes her feel more secure and convincing.

My expectation for them (GP) is not just to prescribe medication based solely on my description. They can use more quantifiable and objective measures, rather than relying on the doctor's subjectivity, to make a diagnosis. It's not that I don't trust the doctor's experience. If they tell me that they make the conclusion based on the examination results, and then prescribe the medication accordingly, that is more convincing than the doctor simply telling me what medication to take. (P5, 71)

In China, some participants take it for granted that doctors are fully responsible for their health. They respect their professionalism and will follow the doctor's advice without making their own needs explicit.

I don't care about how the doctor treats me in the diagnostic process. I just trust them and let them lead the diagnosis based on their medical expertise. My needs... If they think something should be done a certain way, I will follow their instructions as they are professionals. I think that professionals will do their job, and I shouldn't be thinking too much. (P4, 106, 108, 126)

However, in reality, the GP may not know what you want unless you tell them explicitly. As stated by P8, "In China, the doctor always tells you what to do and you follow their instructions. Here, it seems to be the opposite. You decide what you want and go to the doctor to inform your needs. It's like you are partially diagnosing yourself (P8, 123)."

Another difference that participants highlighted is that the UK healthcare system often being conservative. P3 describes that the intervention process is rather conservative in the UK. Doctors will not use any medication unless they feel you have something "significant", as described by P3.

I feel that in China, they prescribe medicines to you easily. But in the UK, they won't prescribe any medication until your condition is severe. Or, they may think that the issue is not significant enough, so they won't prescribe anything and tell you that you don't have any problems. In China, I feel like they often say, 'You have this problem and you need to take this medicine' or something like that. (P3, 70)

#### **6.4.3.3 The feeling of not being valued**

Participants are sometimes unsatisfied with the service quality of the NHS. P8 felt that she was not being supported by the NHS, but rather, she felt that the NHS was a toolbox.

It (NHS) doesn't feel like a support system, it's just a system, not "support". For example, you need to contact them to get X-rays, you need to contact them to get blood tests, and you need to contact them to get medication. It's like they're just your toolbox. You use it when you need it. They will never come to help you. (P8, 121)

Many participants felt undervalued by the NHS. Participants have mentioned specifically about 3 things that make them feel undervalued: doctors not treating them seriously, NHS's passive responses, and ignorance of their personal circumstances. First, P3 felt that the GP was not taking their time to diagnose her. She describes the consultation process as "in a hurry".

I went to see the GP, and they just glanced at my (grey-coloured) nails and said it might be a symptom of cancer, and then they issued me a referral letter to the hospital. That was it, leaving me still confused. The whole process lasted less than 10 minutes. (P3, 129)

Similarly, P1 felt that he was being undervalued as the doctor only asked him a few simple questions and sent him away, without giving any examinations or prescriptions.

Their diagnosis...is a bit vague. They just asked if I had any allergens. I said no, I don't have known allergens. Because of this, I want to know what caused the acute rash. He just asked me some general questions, like when the rash appeared. Then he had a glance at the rash. Then he told me to buy some ointment, and that's it. Probably, he thought there was no need for further examination. (P1, 39-47)

P6 felt dissatisfied as she got doctors' superficial advice after queuing for a long time.

They just advised me to drink more cold water. I was speechless after hearing this advice. What's the difference between whether I go to the GP or not? After all, it's just about drinking water. I feel that, at least, the doctor should give me some information that I do not know, such as advice to avoid spicy food or something. They should tell the patient that although they won't prescribe any medications, they can provide some suggestions from their professional point of view. This way, the patient might feel that they were taken care of. But now they only said that I should drink more water, and that's it. (P6, 38, 46)

Second, NHS responds to patients' questions passively, i.e. they do not respond if patients do not chase them. This sometimes makes participants feel that NHS is irresponsible. P6 had a question and wanted to contact the GP, and she emailed the GP, but they never replied. She called the GP in the end (P6, 26). P3 requested a lab test at her GP, and she submitted the sample, but she never heard back from the GP. This makes her unhappy as she is still waiting for the result.

They never contacted me. I had waited for the result for months. Eventually, I called them to ask for the test result. They told me that if I didn't receive a message, it meant I was fine. This made me feel that they were very passive in dealing with my problem. (P3, 153, 187).

Third, participants were dissatisfied with the fact that the NHS does not take care of their personal circumstances when conducting treatments. After P8 had a leg amputation operation in China due to bone cancer, she called the GP to continue her treatment in the UK. All she wanted was a referral to the specialist to have regular X-rays and CT scans. However, despite her immobility, the GP told her to be physically present at the GP.

I called the GP as soon as I returned to the UK. I asked them to continue my treatment here. At that time, I was in a wheelchair and was not very mobile. I knew what I needed; I just needed to take an X-ray and CT scan. I asked them if I could see the specialists directly for examinations because I didn't have to go over to the GP. The person who answered the call was very indifferent and told me, "You have to come to GP." In the end, it was my friend who pushed me to the GP.

#### **6.4.3.4 Inconsistent policy and advice**

Some participants felt rather confused as the healthcare staff gave them inconsistent and conflicting suggestions. This applied to P2 when he was attempting to obtain the vaccination passport. NHS England told him that they had transferred his record to Scotland's system. On NHS Scotland's website, it suggested that you call them to resolve the issue. However, NHS Scotland staff told him that they did not receive anything from England's side and told him to upload his vaccination record via the GP's system. However, the GP said that they had not been authorised to do this.

I asked them (NHS Scotland staff) why the England side told me that my record had already been uploaded to your system. They replied that they were also confused as to why they didn't have my records. Then they suggested that I contact the GP to try to upload my certificate to the Scotland system, but the GP wasn't very clear on when this policy had been rolled out, and they didn't know how to process it. (P2, 129-131)

Some participants received inconsistent medical advice. P3 had bruised toenails that looked like a symptom of fungal nail infections. She went to the GP to figure out the cause of the "grey-coloured nails" problem. However, she was told by the GP that it

could be a premonitory symptom of some sort of cancer, but the specialist told her that it was not the case.

I want to see the GP to investigate this issue. Although I had some expectations that the doctor would prescribe some medications, I did not expect that they would tell me that it could be a symptom of cancer. Then, they booked me an appointment with the specialist. But when I went to the hospital, the specialist told me that I didn't have any problems. They didn't even do any tests on me, so I was rather confused. It should be a false alarm, maybe. (P3, 135)

#### 6.4.3.5 The feeling of uncertainty

Many participants stated that they feel uncertain when accessing healthcare services. P4 expressed that “I dislike going to a doctor because I don't know what I can get from them. If I know what I can get, I will be more willing to visit them (P4, 106)”.

Participants have complained about the administration and the treatment process not being transparent. P2 described NHS as a “black box” because he never knows how the system processes his matters internally (P2, 187)”, so when dealing with administrative problems, he has to guess “which stage they are in” to estimate time (P2, 189). P8 described the treatment process is completely “blind” to her. “I didn't know how long I had to wait. I didn't know what I was waiting for, and I didn't know what it (the current activity) was leading me to do. (P8, 146)”. P6 did not know the interconnections between pharmacies, General Practitioners, and hospitals. “I know they collaborate, but I do not know how I will be treated and what steps involved.”

Participants also feel uncertain as doctors only draw generic conclusions. P3 pointed out that the doctor never tells you what is going on exactly with your body after the examination. “They are not transparent with you. They will not tell you what exactly is happening (P3, 212)”. P8 elaborated that the doctor should explain the result to her, as she wants to keep informed.

For example, when drawing blood, doctors can explain to me whether the key indicators are low or high. Then they can tell me if I have any problems or not based on the results. In China, when taking X-rays, the doctor will let you see the X-ray photo. Here, they only tell you if you have a problem or not, and you cannot see specific results. (P8, 105-107)



## Part 2: Chatbot Design Requirements

Participants envisioned a range of chatbot designs that they would like to be helped with, including 1. dealing with administrative matters. 2. resolving minor, 3. chronic, and 4. urgent illnesses.

### 6.4.4 Storyboards of chatbot designs

This section answers RQ2.3, “What are the design opportunities for a chatbot to be used to support them, as envisaged by Chinese overseas students?” This section describes Chinese overseas students' needs for chatbot designs. Overall, participants came up with 5 types of chatbot designs that they think are helpful. This includes 1. Chatbot as an information provider to answer enquiries, 2. Chatbot as an educational tool for preparing consultations, 3. Chatbot as a patient portal for online interaction with healthcare staff, 4. Chatbot as a translation tool to facilitate consultation communications, 5. Chatbot as a supportive tool to overcome psychological reluctance. The content analysis results are shown in Table 6.6.

Table 6.6 Types of chatbot features that participants have drawn in storyboards. The table includes chatbot characteristics, the contexts where these features can be used, and the number of participants drawn to these features in the storyboards.

| Chatbot characteristics                                                                    | Contexts                                                         | Frequency of features (# of people drawn) |
|--------------------------------------------------------------------------------------------|------------------------------------------------------------------|-------------------------------------------|
| An information provider to help students make decisions for healthcare service engagements | Resolving administrative matters and minor conditions            | P1, P2, P3, P4, P5, P6, P7, P8 (8)        |
| An educational tool for preparing consultations                                            | Resolving minor, chronic, and urgent conditions                  | P2, P3, P4, P6, P7 (5)                    |
| A patient portal for online interaction with healthcare staff                              | Resolving administrative matters or minor and chronic conditions | P1, P2, P5 (3)                            |
| A translation tool to facilitate consultation communications                               | Resolving minor, chronic, and urgent conditions                  | P3, P5, P6 (3)                            |
| Supportive tool to overcome psychological reluctance                                       | Resolving minor conditions                                       | P4 (1)                                    |

The most popular feature is “chatbot as information provider”. All participants envisioned using the chatbot as an information provider to answer things that they do not know when they make treatment decisions. 5 participants thought of utilising the chatbot as an educational tool to help them become familiar with the UK healthcare system and practice communication skills. 3 participants also treated the chatbot as a digital medium of interaction with NHS staff. The same number of participants thought of using the chatbot as a translator to facilitate doctor consultations. 1 participant

mentioned using the chatbot to reassure her emotionally. The thematic analysis results of envisioned chatbots are described in the following subsections.

#### 6.4.4.1 Chatbot as an information provider to answer enquiries

All participants described the chatbot to be a healthcare information provider. They envisioned that the chatbot would always be available to answer their enquiries about healthcare services. When they encounter something that they do not know, they can quickly ask the chatbot to give them a definitive answer.

Participants want the chatbot to provide administrative information (c.f. section 6.4.2.1). Since P2 waited a long time to obtain vaccination passports, he wanted the chatbot to provide information on the steps to get vaccinated and an estimation of the time to get the vaccination passport, so that he could plan his travel accordingly (P2, 208-210). P3, P4 and P5 had a hard time finding an available GP to register with when they first arrived in the UK, so they wished the chatbot could support them to register with GPs. P5 specified that the chatbot can give her a summary list of GPs that take new patients, with their addresses and contact information, given that she tells the chatbot where she lives. This can save her a lot of effort to look up NHS and GPs' websites to find a GP that can take her.

You don't actually know how many GPs are still accepting new patients. You have to look at each GP's website to learn it. The NHS official website won't help you either as they don't have the feature to filter GPs in your region that are "accepting new patients", so if there is a chatbot, it can tell you a list of GPs that accepting new patients, with their appointment and registration methods, it would be much more convenient for me. I save a lot of effort searching and reading the websites. (P5, 163)

Given the difficult experiences that they have had with GP registration (c.f. section 6.4.2.1), P3, P4, P5 and P7 also felt pessimistic about booking appointments with the GP. They would like the chatbot to explain the GP booking process to new students in detail so that they can understand what to expect from them before their first visit.

(I think the chatbot should let me know) First, is how to book a meeting. Then, I might tell the chatbot about why I am thinking of going to the GP, and it should be able to tell me about the process of achieving my goal and how to book the appointment. You also need to know how to express your needs to the GP. (P7, 100)

The chatbot should instruct me to find the contact information of the GP. Then tell me to choose a specific doctor of my preference. Before I make the call, the chatbot should tell me that I need to get ready for the personal information, like the name, address, date of birth, etc. The chatbot gets me prepared before the registration. (P3, 247)

Participants also hope that the chatbot is capable of providing information about UK medications, because many participants, especially new students, stated that they were not familiar with UK medications (c.f., section 6.4.2.6). Particularly, P4 summarised that the chatbot explains three things: the difference between Chinese and UK medications, the function and the instruction to use a specific medicine, and where to get it (P4, 166). Since P5 was running out of medicines that she brought from China, she desperately wanted the chatbot to help her look up the equivalent UK medication that she was using.

Right now, I am about to run out of the medication which I brought from China. Since I haven't registered with a GP yet, I don't know what medication in the UK has the same efficacy as the one that I am taking now. If the chatbot can tell me the name of the UK medication that has the same active ingredients, that could be a great help. (P5, 131)

Additionally, P4 feel that the chatbot should be able to provide information about the name, the target symptoms of the medication, and the way to use it, as it can fulfil the sense of safety.

The message should include what the medication is called, what the medication is for, and also its precautionary instructions, such as avoiding certain things when taking it, and whether it is best to take it before or after meals. It's like instructions that are written in the manual. I'd like to use the chatbot because of its convenience, as it can summarise the manual. (P4, 277)

Having this message fulfils the psychological need for safety. I feel uncertain about taking the medication that I don't know. The more you know about the medication that you've brought or you've prescribed, the more at ease you will feel when taking the medication. (P4, 236)

P4 also added that the chatbot should provide information on ways to access the medication.

"I am sometimes not sure about where and in which ways to obtain the medication, whether it is a prescribed one, or you need to ask the pharmacist to buy it, or you can simply buy it on the shelf. If the chatbot can show me where to buy and how to buy it, that would be very useful." (P4, 168)

A step further from providing medication information, some participants envisioned that the chatbot could give medication recommendations based on their description of the symptom. In this way, they do not have to bother the GP when they have minor illnesses. P3 stated, “I know it may be hard to implement, but I’d like to input symptoms that I have, and then it returns what medication I may want to buy. (P3, 219)”.

Some participants mentioned that they were not familiar with the NHS’s treatment process (c.f. section 6.4.2.2). They would like the chatbot to help them understand how the treatment is being carried out so that they will know what to expect at each stage. P4 wanted the chatbot to illustrate the entire treatment process in the form of video segments (P4, 204).

The treatment process, regardless of whether it's urgent or chronic, it will be a great help if the chatbot can tell me what the process looks like at the start of the treatment. For example, when at the stage of screening, the chatbot can tell me to contact a GP first. Actually, I didn't know any of these things when I first used NHS services. I was completely clueless about what I needed to do. I didn't know when to expect things to happen, what I was waiting for, or what I needed to do next. In fact, it wasn't until the second year of my undergraduate when I went through this process and figured out that I needed the GP's referral in order to get an X-ray test. If the chatbot could tell me what I'm waiting for and what the process looks like before I commit to the treatment, I could avoid a lot of uncertainty and confusion (P8, 146).

Some participants anticipated that the chatbot to have some degree of advanced intelligence. Participants envisioned that the chatbot could understand their conditions and give recommendations on what they might do accordingly. P6 described that the chatbot would be super helpful if she were in an urgent situation and the chatbot can provide a list of actions that she might want to do with their possible outcomes (c.f. section 6.4.2.3).

For example, if I have an urgent condition and don't know what to do, I can ask the chatbot for advice. (I describe the problem to the chatbot) Then, the chatbot categorises this problem according to the degree of severity. The chatbot would suggest to me if the problem needs to be solved within several days, 48, or 24 hours, and then present a list of treatment options that I can choose from, such as going to the GP, calling 111, or finding a private doctor, etc. and what are the possible outcome of each option might be, such as waiting, receive urgent aids, or need further examinations. (P6, 102, 134)

In addition, some participants anticipated the chatbot to embed localised information because this allows them to ask context-specific enquiries. For example, they would like to ask questions about pharmacists and GPs around them (P5, 163), such as their contact information, opening hours and addresses. With this feature, they can quickly access the service they need without spending time reading through the search engine results.

For example, the chatbot can show me the address and contact information of all NHS services. Since NHS has various sub-systems, I was wondering if the chatbot could tell me, for example, where I can take X-rays and where I can take CT scans, because every hospital has different sets of equipment, and I may know where I can seek specialised treatment after having this kind of information. (P8, 140)

If you enter a medication name, the chatbot may be able to give you a piece of information about where you can buy it or access it. It can provide a list of pharmacies that are selling these medications with their addresses. (P4, 168)

#### 6.4.4.2 Chatbot as an educational tool for preparing consultations

Some participants see the chatbot as a source of information and would like to use it to learn “common knowledge” about healthcare services in the UK. As mentioned in the difficulty section (c.f. section 6.4.2.2), participants are unfamiliar with NHS and how it works. Therefore, some participants proposed using the chatbot to teach them how the UK healthcare system functions. Unlike asking a question about the treatment process, participants hoped to let the chatbot introduce them to all kinds of UK healthcare services and how these services can be used to support them, such as how the NHS system works, the role of the GP, the role of pharmacy and the role of specialists, where to go, how to be referred, and what the treatment process looks like.

If the chatbot knows that I am a new student, it will introduce me to the “common” knowledge of the UK healthcare system. For example, how NHS composite and different services work with each other. I still don't understand the relationship between hospitals and other facilities. It would also be helpful to have specific information about pharmacies and the differences in obtaining prescribed and non-prescribed medications, which medications you can buy from the shelf, which medications need a prescription and any regulations in place. (P4, 220)

(I like to chatbot to explain) What the GP can and cannot do for you. If I want a referral to the specialist, but the GP refuses to do so, what are

the other options? If I want to solve my problem, should I contact a private doctor, or are there any other options? What are the limitations of the NHS? For example, they cannot find a specialist quickly. I'd like the chatbot to tell me what the NHS can do and what it cannot do. (P8, 132)

Another popular proposal is to treat the chatbot as an agent to get them prepared for the consultation because some participants expected to have a hard time when articulating their needs (c.f., section 6.4.2.5). P7 wanted to book with the GP to start her HRT in the UK, so she would like the chatbot to introduce her to some conversational techniques so that she can book the appointment quickly and negotiate with the doctor to start her treatment successfully.

If I need an examination, how should I express my need to book a GP appointment? Or if I need HRT, how should I persuade the GP to allow me to start the gender identity disorder treatment? I know many GPs avoid discussing these topics as it can make their job harder. (P7, 102)

P4 and P7 specified further that the chatbot can be used to train them about what to say during the consultation so that they would be able to articulate their needs clearly. They would like to see the chatbot provide questions that might come up during the conversation, and examples of sentences that answer these questions.

It can provide a list of questions that doctors may ask in the consultation. I know doctors always follow a specific protocol for diagnosis. The chatbot can simulate this process to inform you of the possible questions that they may ask. Preparation allows me to think in advance about my condition and highlight the key points before I speak to the doctor. (P4, 220)

The chatbot can introduce you to some of the questions that might come up in the conversation and examples that answer these questions. For example, if you have a fever, the chatbot will let you know that the doctor will ask you about how you have felt in the past few days. The chatbot will also list some possible answers to those questions for your information. If you think you have the flu, choose one answer. If you think your fever is caused by some other illness, you can choose another answer. There are different causes of fever; the chatbot can list common causes and ways to express them. (P7, 124, 126)

#### 6.4.4.3 A patient portal for online interaction with healthcare staff

Participants have complained about the non-transparency in administration and the treatment process (c.f. section 6.4.3.5). Therefore, some participants envisioned the chatbot to be a digital “portal” or a “channel” to connect patients and NHS services. P2 wants to be more transparent in contacting the service. In this way, they do not have to make calls whenever they have concerns about the administration and treatment process.

P2 described the chatbot as a “customer support” interface. He imagined that patients could input enquiries into the system, and a real person behind the chatbot could help them resolve their enquiries. The chatbot interface can automatically log and track unsolved issues.

I imagine the chatbot can be used to record all my enquiries in one place. When I have a problem, the NHS staff can chat with me to resolve the problem via this online interface. In case my problem needs to be transferred to different departments to resolve it (such as the GP and specialist), staff from the other department can look at my chat history to know about the context of my problem. Everyone (staff) can see my descriptions of the problem, so I don't have to call them and repeat my problem again and again. (P2, 214)

P5 suggested using the chatbot as an interface for registering with GPs. The chatbot can search for available GPs around her who accept new patients. She envisioned that the chatbot to implement a reminder feature to nudge her about the number of available places in her area.

The chatbot can implement a reminder function that tells me the percentage of GPs registered in my region, and the number of places still available. When I was registering with the GP, I spent a month or two browsing different GPs' websites constantly to see if they had any spots available. If the chatbot has a reminder function to let me know which GP has available spots, that would be a lot easier. (P5, 121, 213)

As some participants pointed out, doctors in the UK do not like to share their diagnostic results with the patient (for example, P3, 212), so participants propose to write down this kind of information inside the patient portal system. Students can ask the chatbot to retrieve the diagnostic result to understand what is going on with them. P4 stated, “If possible, it would be best to record diagnostic data and the doctor's advice in text form so that I can make sense of them. (P4, 226)”

P1 was unsatisfied with the time to wait to see the GP. At the same time, he knows that the doctor can be busy handling a lot of patients; therefore, he suggested using

an intelligent chatbot to pre-assess the patient and record their symptoms before the consultation. This can save the time of screening. For minor problems, doctors can just leave their comments without the need for consultation (P1, 210-216).

#### **6.4.4.4 Chatbot as a translation tool to facilitate communications**

Participants were concerned that they would not be able to understand the doctor's advice, or they worried that they could not articulate their needs precisely (c.f. section 6.4.2.5). They suggested the chatbot should embed a translation feature to help them overcome language and communication problems.

P4 stated that it is a pain point that she may not understand the medical terminology when talking to doctors (P4, 226). P3 suggested it would be best if she could input her symptoms in Chinese, and the chatbot translates her symptoms into English sentences, because "it can assist me to describe my problem and ultimately makes everyone happy. (P3, 234)".

P5 wished that the translation be done in real-time so that she could use this feature when the doctor said something that she did not understand. "It is an app. First, you set the language, and then the chatbot can recognise your voice and the doctor's voice. Then, it shows the translation of the doctor's utterance on the screen of your smartphone. (P5, 169, 171)". When talking about translation accuracy, she expressed that it does not have to be 100% accurate. It should be fine as long as there are no big ambiguities.

I think the chatbot should be accurate about medical terminology. You can embed a glossary table into it. However, the translation doesn't have to be literally the same. As long as the general meaning, particularly the medical terminologies and the description of the symptoms, is relatively accurate, that will be fine (P5, 175).

#### **6.4.4.5 Chatbot as a supportive tool to overcome psychological reluctance**

Since participants feel uncertain when engaging in healthcare services (c.f. section 6.4.3.5), P4 proposed using the chatbot to overcome psychological reluctance.

When it comes to overcoming psychological barriers, I think the chatbot should tell you the process of the treatment and the common knowledge about visiting the doctor. This will turn unknowns into



knowns. In addition, it can also display some reassuring statements so that you do not stress out. (P4, 200,221)

## 6.5 Discussion

### 6.5.1 Healthcare journeys and pain points

Participants illustrated four types of healthcare journeys. (Section 6.4.1) 1. Dealing with administrative matters, 2. Resolving minor problems, 3. Chronic problems, and 4. Handling urgent health conditions or emergencies. This answers RQ2.1, “What kind of healthcare journeys that Chinese overseas students experienced?”. Overall, 4 participants visited healthcare services to deal with administrative matters (P2, P4, P5, P7); 4 participants reported access to healthcare services to resolve minor problems (P1, P3, P5, P6); 3 participants mentioned they have to go to the urgent care unit because of acute health problems (P5, P6, P8); 2 participants illustrated their experiences for continuing chronic treatments in the UK (P7, P8). We have more than 8 healthcare journeys, as some participants mentioned more than one journey, and some of the journeys contain more than one element. The summary of participants' health journeys is shown in Table 6.3.

We identified a range of pain points in participants' healthcare journeys. From the content analysis, we identified 13 kinds of difficulties and 9 types of dissatisfaction (Tables 6.4 and 6.5). From the thematic analysis, we identified 7 types of problems and 5 kinds of dissatisfaction (Section 6.4.2.X, 6.4.3.X). Interestingly, we found that many pain points from the content analysis and results from the thematic analysis have similar meanings. This alignment is illustrated in Table 6.7.

Table 6.7 Pain points alignments. Pain points from the content analysis (including both difficulties and dissatisfactions) and themes from the thematic analysis (including problems, difficulties, and dissatisfactions in healthcare journeys) aligned with each other.

| Pain points from the content analysis  | Results from the thematic analysis             | Descriptions of pain points and themes                                                        |
|----------------------------------------|------------------------------------------------|-----------------------------------------------------------------------------------------------|
| Medication problem (7 participants)    | Problems in medications (section 6.4.2.6)      | Participants were not familiar with UK medications and ways to access them                    |
| Communication problem (7 participants) | Problems in minor conditions (section 6.4.2.5) | Participants were worried about running into language problems when interacting with doctors. |

|                                                                 |                                                                              |                                                                                                                                                       |
|-----------------------------------------------------------------|------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| Consultation problem (6 participants)                           | Problems in minor conditions (section 6.4.2.5)                               | Participants found it hard to articulate their symptoms and needs                                                                                     |
| Emergency problem (5 participants)                              | Problems in urgent and emergency conditions (section 6.4.2.3)                | Participants did not know if, and what to do in urgent situations or emergencies                                                                      |
| Booking appointment (5 participants)                            | Problems in GP registration and dilemmas in administration (section 6.4.2.1) | Problems in arranging appointments with healthcare services, usually GPs                                                                              |
| Hard to make sense of the UK healthcare system (5 participants) | Unfamiliar with the NHS role and treatment process (section 6.4.2.2)         | Participants found it hard to make sense of the UK healthcare system and how it works together                                                        |
| Searching online (5 participants)                               | Problems in online searching (section 6.4.2.7)                               | Problems in searching for healthcare information online                                                                                               |
| GP registration (3 participants)                                | Problems in GP registration and dilemmas in administration (section 6.4.2.1) | Problems in registering with a GP, usually participants found it hard to find one that accepts new patients                                           |
| Belief problems (3 participants)                                | Prior experiences in China and unmet expectations (section 6.4.3.2)          | Participants distrust healthcare professionals in the UK, feeling that they are incompetent or unprofessional                                         |
| Emotional reluctance (2 participants)                           | NA                                                                           | Participants are emotionally reluctant to seek professional help                                                                                      |
| Transportation problem (2 participants)                         | NA                                                                           | Participants lived far away to visit healthcare services                                                                                              |
| Conflict resolving (2 participants)                             | Problems in minor conditions (section 6.4.2.5)                               | Participants found it difficult to carry out negotiations and persuade the doctor to fulfil their needs                                               |
| Administrative problem (1 participant)                          | Problems in GP registration and dilemmas in administration (section 6.4.2.1) | Problems in NHS administrations, such as obtaining health records                                                                                     |
| Not being valued or below expectations (8 participants)         | The feeling of not being valued (section 6.4.3.3)                            | Participants were concerned that doctors would not treat them seriously, or that they would receive treatments that did not fulfil their expectations |
| Demanding effort (7 participants)                               | Negative impressions and attitudes (section 6.4.3.1)                         | Participants felt that they needed to spend a lot of time and effort to receive treatments                                                            |

|                                                             |                                                                     |                                                                                                                                 |
|-------------------------------------------------------------|---------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| Feels uncertain about processes (7 participants)            | The feeling of uncertainty (section 6.4.3.5)                        | Participants felt uncertain about what treatment processes look like and what to expect them to do                              |
| Negative impressions (7 participants)                       | Negative impressions and attitudes (section 6.4.3.1)                | Participants think that NHS services are ineffective, inefficient and useless in resolving health issues                        |
| No timely response (5 participants)                         | Problems in minor conditions (section 6.4.2.5)                      | Participants waited for a long time for the NHS to respond to their request                                                     |
| Diverge from prior experiences in China (5 participants)    | Prior experiences in China and unmet expectations (section 6.4.3.2) | Participants' healthcare experience in China did not work in the UK, resulting in unmet needs.                                  |
| Inconsistencies and problems in treatments (4 participants) | Inconsistent policy and advice (section 6.4.3.4)                    | Participants were confused by inconsistencies in medical advice given by doctors or administrative processes given by NHS staff |
| Sharing negative experiences with others (3 participants)   | NA                                                                  | Participants shared their unpleasant healthcare engagement experiences with others                                              |
| WM being ineffective (1 participant)                        | NA                                                                  | NHS does not offer TCM treatments, despite participants feeling that TCM is more effective in treating certain conditions       |

Many pain points are related to the unfamiliarity with UK healthcare services and treatments. Many participants experienced medication problems (i.e., Medication problems). Specifically, participants stated that they were not familiar with UK medications. They did not know the names and effectiveness of UK medicines, and they did not know ways to access them. Participants found it challenging to tackle urgent conditions (i.e., Emergency problems). They did not know if and what to do in urgent situations or emergencies. Given that the healthcare system works differently between China and the UK, some participants did not know the roles of different NHS departments and how they work together. They did not know what the process and the outcome would be, and they did not know what to expect from them (i.e., Hard to make sense of the UK healthcare system, and they felt uncertain about the treatment process). Their expectations often diverge from what the NHS can offer (i.e., Diverge from prior experiences in China). For example, participants visited the GP and were expecting doctors to carry out specialised examinations, while doctors only relied on students' verbal descriptions for diagnosis. This mismatch in expectation made participants think that doctors in the UK are incompetent or unprofessional (i.e., Belief problems). Doctors concluded a case just after having a few rounds of conversation. This led participants to feel undervalued as they saw doctors being "rash" and "careless" in screening (i.e., not being valued). To understand the symptom and their

treatment process in the UK, participants had to spend time using online search engines or social media to read through other people's experiences and learn from them (i.e., Online searching). The mismatch in expectations, the undervalued feeling, and the effort for preparation caused participants to hold a negative attitude towards the NHS, thinking that the NHS was useless and effort-consuming to use (i.e., Negative impressions).

Some pain points are related to participants' insufficient language and communication skills in healthcare contexts. This particularly applies to new students. Due to the difficulty of medical terminologies, participants worried that they were unable to articulate symptoms precisely, understand the doctor's advice fully and answer doctors' follow-up questions (i.e., Communication problems and Consultation problems). Participants also reported that they experienced hard times discussing with doctors to resolve their issues. This is because they were not aware of all available treatment options when making treatment decisions to best fit their circumstances, and they did not know effective ways to persuade doctors if they disagreed with the doctor (i.e., Conflict-resolving). To deal with this issue, participants spend time and effort preparing their arguments before they visit the GP. This language and communication obstacle also contributes to the negative attitude towards the NHS, where participants spend a lot of time and effort preparing for healthcare service utilisation (i.e., Negative impressions).

Other pain points are related to NHS itself. The first is about insufficient resources for the NHS to meet patients' demands. New students described that they had a hard time finding and registering with a GP. They have to queue in front of the GP on cold nights as few GPs accept new patients in their local area (i.e. GP registration). Many participants experienced delays in treatments. For example, participants were asked to attend the GP when they were about to recover. P8 experienced delays in cancer treatments, taking life-threatening risks to be examined (i.e., Booking appointments). The second is about the administrative process being bureaucratic when engaging with NHS. During COVID times, people needed to be tested PCR negative to attend the GP; however, the PCR test can only be arranged if people have symptoms of COVID. This prevents participants from fulfilling their normal medical needs. One participant also experienced confusion across England and Scotland's healthcare systems. Both systems claimed that they had done their part to complete the vaccination record, but no one could issue the vaccination passport for him (i.e., Inconsistencies and problems in treatments). The third is about NHS not offering alternative treatments. Participants believed that TCMs are more effective for certain types of illnesses (e.g., acupuncture for rheumatic disease) and, unfortunately, NHS is not offering such services (i.e., WM being ineffective). NHS's inefficiency also contributes to participants' negative attitudes (i.e., Negative impressions).

In summary, we identified three main groups of pain points: 1. Unfamiliarity with UK healthcare services and treatments (Group 1 pain points), 2. Insufficient language and communication skills in healthcare contexts (Group 2 pain points), 3. NHS administrative issues (Group 3 pain points). These pain points contribute to participants' negative impressions of NHS. This result answers RQ2.2, "What are the pain points in these healthcare journeys?".

### 6.5.2 Comparison of Pain Points and Grounded Theory Study Results

Many pain points discovered in the workshop also match the results of the grounded theory study. This may be because the codes that we were using in both analyses came from the focused codes in the grounded theory study. Only 4 pain points did not appear in the thematic analysis: "emotional reluctance", "transportation problem", "sharing negative experiences with others" and "WM being ineffective". One explanation of this is that participants choose to elaborate on topics that are more important to them in the workshop, and these four pain points are self-explanatory.

In Chapter 5, we learned that Chinese students hold a negative attitude towards healthcare services in the UK, and they are reluctant to seek professional assistance. The framework of healthcare service utilisation (Chapter 5, Section 5.4.1) showed that Chinese students' decision-making process of healthcare service utilisation can be illustrated by 5 categories, i.e., "Perceived difficulties to use", "Attitude towards UK healthcare services", "Social influence", "Direct motivation to use", and "Post-decision behaviours". "Perceived difficulties to use", "Attitude towards UK healthcare services", and "Social influence" are the 3 key determinants for healthcare service utilisation. Together with the context-dependent category "Direct Motivation to use", these 4 categories determine the intention of healthcare service utilisation. Students with low intention will perform self-intervention "Post-decision behaviours", and students with high intention will perform health visits "Post-decision behaviours". In the workshop, we examined pain points in participants' healthcare journeys. We identified 13 types of difficulties and 9 kinds of dissatisfaction from the content analysis, and we identified 7 types of problems and 5 kinds of dissatisfaction from the thematic analysis. We found that most pain points coincide with sub-categories of "Perceived difficulties to use" and "Attitude towards UK healthcare services" in the grounded theory study.

In the "Perceived difficulties to use" category, we found 5 types of difficulties that Chinese students considered to be difficult when considering visiting healthcare services. The "Language and communication barrier" describes Chinese students' concerns about not familiarising medical terminologies in English, and worries about ineffective communication due to the lack of mutual understanding. For example, the

doctor may not recognise students' individual situations and needs, and students may not understand the doctor's role and responsibility (e.g., doctors in GP cannot conduct specialised tests). These coincide with the workshop pain points "Communication problem", "Consultation problem" and "Conflict resolving". Participants were worried about running into language problems when interacting with doctors. They found it hard to describe symptoms and articulate their needs precisely. They may not be aware of the treatment options available and they were concerned about their ability to persuade the doctor. The "Organisational disorientation" describes Chinese students' concern about navigating the NHS system to access medical care. Students may have a difficult time making sense of different services and knowing what to do to receive proper treatment. This aligns with the workshop pain points "Hard to make sense of the UK healthcare system", and "Feels uncertain about processes". Participants were unfamiliar with various NHS services and what they are for. They did not know the full picture of the treatment process, and they did not know what to expect at each step of the treatment. This problem was exacerbated in the context of emergencies. Some participants did not know where to seek help and what to do in urgent situations (i.e., Emergency problems). However, in the "Organisational disorientation" category, we included the difficulty of booking appointments and registering with the GP, as students were unfamiliar with the booking and registration process. This changed in the workshop, where participants regarded these problems as administrative problems. Participants know about how these processes work, but NHS did not allocate enough resources to make appointment booking and GP registration easier. The "Emotional and cognitive burdens" describe Chinese students' emotional fears about visiting healthcare services and diminished cognitive ability in emergency conditions. This partially aligned with the "Emotional reluctance" pain point in the workshop, where some participants mentioned that they were reluctant to seek professional help. The sub-category "Sociocultural matters" describes several sociocultural factors that impede Chinese students' healthcare service utilisation, including the need for TCM practices, the positionality between doctors and patients, differences in living styles, and cultural taboos. The workshop pain point "WM being ineffective" included a participant's desire to add TCM treatments to the NHS. We did not find any workshop pain points that related to the "Interpersonal barrier" as the focus of the workshop is on the patient and NHS.

The "Attitude towards UK healthcare services" category describes Chinese students' impressions, attitudes, and feelings towards healthcare services. Many of the sub-categories in this category involve students' dissatisfaction. In the "Impression towards the NHS" sub-category, most students perceived the NHS to be inefficient, effort-consuming and sometimes unprofessional. The same impression was also found in the workshop, participants felt that NHS services were ineffective, inefficient and useless for resolving their health issues (i.e. pain point "Negative impressions"). The sub-category "Time, effort and benefit evaluation" describes Chinese students' internal

decision-making process for healthcare service utilisation. Many of them felt that they had to put in a lot of effort to prepare for the visit but only received limited returns. This link to the workshop pain points, “Demanding effort” and “Not being valued or below expectation”. Participants felt that they had to spend a lot of time and effort to arrange the consultation, but received superficial diagnoses and simplistic advice that did not fulfil their needs. The sub-category “Personal beliefs” describes Chinese students’ expectations of what UK healthcare services can do. Students often overestimate what the primary service can offer. The workshop pain point “Diverge from prior experiences in China” found that participants were often dissatisfied with the service because they assumed that doctors in the GP should be able to conduct specialised examinations and resolve their problems instantly (like the doctors in hospitals did). This gap between expectation and reality made some participants distrust healthcare professionals, feeling that doctors were incompetent or unprofessional (i.e. pain point “Belief problems”). Since pain points focused on difficulties and dissatisfaction in healthcare journeys, we did not include positive feelings and thoughts in the workshop.

The “Post-decision behaviours” refer to Chinese students’ actions after deciding whether to use healthcare services. The subcategory “Alternative management behaviour” describes Chinese students’ post-decision behaviours in managing health conditions themselves. The results from the grounded theory illustrated a common self-management pattern: 1. ignore the symptom first, 2. try to use and purchase medications, and 3. then go to see a doctor if the symptom persists. In the workshop, participants further elaborated on problems in using and purchasing medications (pain point “Medication problems”). They were not familiar with UK medications. They were not familiar with the names and functions of UK medications. They were also confused about ways to access prescribed and non-prescribed medications in the UK. If the student chose to visit healthcare services, they would spend time searching online to understand the symptoms and familiarise themselves with potential treatment processes, as illustrated in the subcategory “Demanding preparations”. In the workshop, participants elaborated that they wasted a lot of time cross-validate information that they read online because it was hard to find a reliable source to answer their questions. For example, symptoms and treatment procedures, and descriptions and instructions to use UK medications (i.e., the pain point “Searching online”). The “Tactics to overcome difficulties of healthcare service utilisation” category describes strategies that students use to tackle problems during healthcare service utilisation. Within this category, people mentioned describing the symptom exaggeratedly to gain quicker access to the GP. The same strategy was also used by workshop participants, who described their conditions seriously to gain quicker access to treatments as well as get the treatment they wanted (persuade the doctor).

The category “Social influence” does not frequently appear in the workshop, despite participants mentioning sharing negative healthcare experiences with their colleagues (i.e., the pain point “Sharing negative experiences with others”). This action was also identified in the grounded theory study, where students “TuCao” about their unpleasant healthcare experiences, mainly on the appointment waiting time. We did not capture any other sources of social influence (such as encouragement from family members) in the workshop because workshop activities were designed purposefully to investigate interactions between patients and NHS, not looking at other people.

In summary, a lot of pain points match the results in the grounded theory study. Most pain points are covered in the “Perceived difficulties to use” and the “Attitude towards UK healthcare services” categories in the grounded theory study. This is as expected, as pain points describe issues and dissatisfaction in healthcare journeys. Some pain points elaborated on the themes of the grounded theory study. For example, the difficulty in knowing and accessing UK medications, and the difficulty in searching online as a result of insufficient reliable information sources. Since the focus of workshop activities is on the interaction between the patient and healthcare providers, we did not identify any pain points that related to the third party (e.g., social influences, interpersonal problems). However, different from the grounded theory, where difficulties in booking appointments and GP registration were regarded as the result of students’ unfamiliarity with the UK healthcare system, we felt that these difficulties were also due to NHS itself. NHS did not provide enough resources to meet students’ demands, resulting in delays in treatments and limited GP registration slots. The theme of “NHS’s internal problems” is newly discovered in the workshop. This includes pain points “No timely response” (NHS being slow to respond to students’ requests), “Inconsistent policies” (NHS have different, or even conflicting policies for treatments), and “Problems in administrations” (Some processes in NHS are bureaucratic, such as obtaining health records).

### 6.5.3 Design requirements from students’ perspective

In the results section, participants envisioned 5 types of chatbot designs (or characteristics) to support their healthcare service utilisation: 1. Chatbot as an information provider to answer enquiries (c.f. Section 6.4.4.1), 2. Chatbot as an educational tool for preparing consultations (c.f. Section 6.4.4.2), 3. Chatbot as a patient portal for online interaction with healthcare staff (c.f. Section 6.4.4.3), 4. Chatbot as a translation tool to facilitate consultation communications (c.f. Section 6.4.4.4), 5. Chatbot as a supportive tool to overcome psychological reluctance (c.f. Section 6.4.4.5). The summary of participants’ requirements for chatbots is shown in Table 6.8.



Table 6.8 examined detailed pain points (design opportunities) and chatbot design requirements. The pain points describe the details of the issues to be addressed. The design requirements describe the chatbot characteristics that participants would like to implement. This answers [RQ2.3] to form concrete design specifications for implementing the chatbot prototype (Section 7.2.2).

Table 6.8 A list of potential design opportunities (pain points) and design requirements for chatbots proposed by participants.

| Pain points (Design Opportunities)                                                                                                              | Design requirements                                                                                                                                                        |
|-------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Medication problem:</b> participants were not familiar with UK medications and ways to access them                                           | Information provider:<br>1. Gives guidance on the use and access of medications in the UK<br>2. Recommend medicines if possible                                            |
| <b>Communication problem:</b> participants were worried about running into language problems when interacting with doctors                      | Translator:<br>1. Look up and translate the medical terminologies between Chinese and English<br>2. Real-time voice translation between doctors and students               |
| <b>Consultation problem:</b> participants found it hard to articulate their symptoms and needs                                                  | Educator:<br>Practice consultation conversations, highlighting what will come up in consultation                                                                           |
| <b>Emergency problem:</b> participants did not know if, and what to do in urgent situations or emergencies                                      | Educator:<br>Introduce students to how the UK emergency service works, when and how to access it                                                                           |
| <b>Booking appointment:</b> problems in arranging appointments with healthcare services, usually GPs                                            | Patient portal:<br>Having a medium to book appointments digitally. Able to see available time slots                                                                        |
| Hard to make sense of the UK healthcare system: participants found it hard to make sense of the UK healthcare system and how they work together | Educator:<br>Introduce students to the UK healthcare system, including roles of different services, how they work with each other, when to use them and how to access them |
| <b>Searching online:</b> problems in searching healthcare information online                                                                    | <b>Information provider:</b> Provide information from official sources directly. No searching is needed.                                                                   |
| <b>GP registration:</b> problems in registering with a GP, usually participants found it hard to find one that accepts new patients             | Patient portal:<br>Search for available places to register with the GP                                                                                                     |
| <b>Belief problems:</b> participants distrust healthcare professionals in the UK, feeling that they are incompetent or unprofessional           | NA                                                                                                                                                                         |
| <b>Conflict resolving:</b> participants felt difficult to carry out negotiations and persuade the doctor to fulfil their needs                  | Educator:<br>Introduce students to conversational persuasion and negotiation techniques                                                                                    |

|                                                                                                                                                                                               |                                                                                                                                                                |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Administrative problem:</b> problems in NHS administrations, such as obtaining health records                                                                                              | Patient portal:<br>Having a channel to contact “customer support”, and keep track of unresolved problems                                                       |
| <b>Not being valued or below expectations:</b> participants were concerned that doctors would not treat them seriously, or that they receive treatments that do not fulfil their expectations | NA                                                                                                                                                             |
| <b>Feels uncertain about processes:</b> participants felt uncertain about what treatment processes look like, and what to expect them to do                                                   | Information provider:<br>Answer questions about treatment processes, showing students how the treatment is being carried out and what to expect at each stage. |
| <b>Negative impressions:</b> participants think that NHS services are ineffective inefficient and useless in resolving health issues                                                          | NA                                                                                                                                                             |
| <b>No timely response:</b> participants waited for a long time for the NHS to respond to their request                                                                                        | <b>Patient Portal:</b> Having a channel to track students’ requests, showing the process of processing the request                                             |
| <b>Diverge from prior experiences in China:</b> participants’ healthcare experience in China did not work in the UK, resulting in unmet needs                                                 | NA                                                                                                                                                             |
| <b>Inconsistencies and problems in treatments:</b> participants were confused by inconsistencies in medical advice given by doctors or administrative processes given by NHS staff            | Patient Portal:<br>Record medical or administrative advice inside the portal. Students can ask the chatbot to retrieve advice and ask for further enquires     |

From Table 6.8, most pain points were caused by one of the three underlying problems (Section 6.5.1), “Unfamiliar with UK services” (Group 1 pain points), “Insufficient communication skills” (Group 2 pain points) and “NHS’s internal problems” (Group 1 pain points).

For Group 1 pain points, participants would like to use the chatbot as a source of information to help with making healthcare decisions. For example, when they have minor conditions, they would like to use the chatbot to get to know about UK medications and how to use and access them. Before committing to treatments, they would like to ask the chatbot about what to expect in the treatment process. An alternative proposal is to use the chatbot to give overviews about the roles of different services, how they work, and how to access these services. Additionally, the chatbot could also compare the differences between the UK and China to help them reshape their expectations. In this way, participants would not be disoriented when having health conditions.

For Group 2 pain points, participants envisioned using the chatbot to translate consultation conversations so that they could speak out their symptoms and needs confidently and understand medical advice precisely. They also expected to use the chatbot to teach them about what might come up and what to do if they disagreed with the doctor. They worried that they still could not articulate their needs and understand the doctor's advice precisely while screening, despite they may have been prepared. They wish the chatbot to embed a real-time translation feature so that they can always ask the chatbot when they encounter things that they do not understand in the screening.

For Group 3 pain points, participants wish to use the chatbot as a patient portal to easily contact the GP or NHS when they run into problems that cannot be solved by themselves. If the problem cannot be resolved quickly, they would like to keep track of the progress. The main idea for addressing these pain points is to simplify the administration process and make it transparent. For example, students wished to see doctors' availability online when booking appointments, instead of phoning the reception to ask for their help every time they have a simple need. They also wish to use the chatbot as a medium for keeping track of procedures and diagnostic results and communicating with doctors if they have concerns. These features keep them in the loop of the treatment.

In addition, participants would also like to use the chatbot as a source of encouragement to overcome psychological reluctance. When dealing with minor conditions, new students may feel uncertain about what will happen in the GP. Thus, adding some reassuring statements, such as "it will be alright", to the chatbot can make them feel less stressed.

#### **6.5.4 Limitations**

In this chapter, we hosted Co-design workshops to collect Chinese students' healthcare journeys, and we identified various pain points in their journeys. We also investigated students' chatbot requirements to address these pain points. However, this study has some limitations, particularly in 3 aspects: the workshop sampling, the workshop design, and the findings of the role-playing activity.

The first limitation is regarding the sampling of the study. Due to resource constraints, we only collected data from Chinese students who studied in Edinburgh. Some of the pain points may be biased towards Edinburgh and Scotland, for example, the difficulty of registering with the GP. For the same reason, we did not recruit any healthcare staff or professionals for the workshop. While one aspect of Co-design is to exchange of information and expertise during the design process, the exchange of ideas only takes

place between the participant (a Chinese student) and the workshop facilitator. This limits the angle of pain points and what can be addressed. Our results only reflect pain points and design requirements from the patient's perspective. For example, some of the chatbot designs may not be practical to implement as neither the participant nor the facilitator knows exactly how NHS works internally, e.g., using chatbots to resolve NHS administrative problems. In addition, we only collected healthcare journeys from 8 participants, although it might be sufficient given that pain points findings are aligned with the grounded theory study results, there might still be undiscovered requirements of chatbot designs.

The second limitation is the design of workshop activities. We initially planned to invite 3 to 4 participants in one workshop session so that they could exchange ideas during the design process. However, due to COVID regulations, we can only host the workshop in a small room and invite one participant at a time to conduct the workshop. While this did not affect much in identifying pain points in healthcare journeys, participants' discussion of chatbot designs was uninspiring. In the results, despite hard thinking, some participants could only think of technologies that have already been used in the real world, such as implementing the chatbot in the form of translation apps and online booking systems. It would be better if multiple participants brainstormed the chatbot together to come up with more innovative ideas.

The third limitation is associated with findings in the role-playing activity. In the workshop design, we specified that the last design activity was the role-play between the user and the chatbot. The original purpose is to let participants output meaningful chatbot materials that may be reused in the actual chatbot implementation. However, in practice, we found that this activity did not meet this purpose. Participants were only capable of writing low-fidelity scripts to demonstrate the chatbot features that they came up with. This is because of the gap between people's imagination and reality. They did not know how NHS works systematically. For example, some participants proposed building patient portals, but they did not know what data should be shared between the patient, the GP, and the NHS; some participants did not know anything about UK medication when proposing to use the chatbot to recommend medications. As a result, despite helping participants to reflect on their designs, the role-play activity was simply a repetition of storyboards, to illustrate how the chatbot might work. In the future, we might provide more materials to allow participants to "play around". Participants may gain a deeper understanding of reality by incorporating materials provided when writing scripts.

### 6.5.5 Conclusion

In this chapter, we conducted a Co-design workshop with Chinese overseas students to investigate design opportunities of chatbots in addressing problems in healthcare service utilisation. We investigated Chinese students' healthcare journeys from a service design angle. To answer RQ2.1 and RQ2.2, "What kind of healthcare journeys that Chinese overseas students experienced?", "What are the pain points in these healthcare journeys?", we used the journey-mapping activity to unfold Chinese students' experiences in accessing healthcare services and identify pain points in these journeys. To answer RQ2.3 "What are the design opportunities for a chatbot to be used to support them, as envisaged by Chinese overseas students?", we used the storyboarding activity to elicit Chinese students' design requirements for chatbots in addressing pain points in the healthcare journeys. By the end of this study, we collected 8 participants' healthcare journeys and their needs for chatbot designs. We carried out the content analysis and thematic analysis of workshop materials and audio transcriptions respectively. The results from both analyses triangulate with the grounded study, showing that Chinese students generally hold negative impressions towards NHS, and they share similar kinds of difficulties and dissatisfactions in healthcare service utilisation.

Overall, participants illustrated 4 types of healthcare journeys [RQ2.1]: 1. dealing with administrative matters, 2. resolving minor health problems, 3. resolving chronic health problems, and 4. handling urgent health conditions or emergencies. Participants elaborated on three groups of pain points in these journeys [RQ2.2]. 1. unfamiliarity with UK healthcare services and treatments, 2. insufficient language and communication skills in healthcare contexts. 3. Issues with NHS itself. Based on the pain points discovered, participants would like to use the chatbot in 5 ways: chatbot as an information provider, as an educational chatbot, as a translator, as a patient portal, and as a source of reassurance [RQ2.3].

Findings from this study summarised design opportunities and design requirements of chatbots to support Chinese students' healthcare service utilisation in the UK. Participants described their healthcare journeys, with details about difficulties and dissatisfactions. Participants' needs for chatbots helped us to decide on the chatbot prototype specifications. With these concrete findings, we are now already gearing toward the chatbot implementation. The key contribution of this chapter is listed below.

1. Collected Chinese overseas students' experiences in accessing UK healthcare services from a service design angle. We identified 4 types of healthcare journeys, including dealing with administrative matters, 2. resolving minor health problems,

3. resolving chronic health problems, and 4. handling urgent health conditions or emergencies.
2. Carried out the content analysis and thematic analysis on workshop materials and audio transcriptions. We identified common types of difficulties and dissatisfactions in healthcare journeys. The results were triangulation with the results from the grounded study.
3. Summarised participants' chatbot design requirements (or characteristics) to address pain points in healthcare journeys (Table 6.8).

## Chapter 7: Chatbot Prototype Design and Implementation

### 7.1 Introduction and Motivation

In Chapter 5, I investigated Chinese overseas students' healthcare experiences in the UK. We confirmed and explained that Chinese overseas students tend to avoid using healthcare services unless the condition is serious. In Chapter 6, I examined their healthcare journeys in detail and identified a list of design opportunities for chatbots to tackle issues in healthcare service utilisation. In this chapter, I describe the design and implementation of a chatbot prototype which aims to positively affect Chinese students' intentions in utilising UK healthcare services.

The goal of this chapter is to document the design choices and the design process of the chatbot, including the design of dialogue contents and the implementation of the chatbot prototype. This chapter is structured in the following steps: First, I grouped students' pain points and design requirements that were identified in Chapter 6 into three distinct personas, and I explained the choice of the target user group. Next, guided by the Persona, I discussed design decisions that shape the chatbot content. I decided on the form of the chatbot and elicited specifications of the chatbot content with consideration of students' needs and practical constraints. After that, I discuss the design choices being made for the implementation and describe the development process of the prototype. The chatbot prototype's architecture, conversation management behaviour and dialogue content are also illustrated for documentation. Finally, I conclude this chapter with a summary of the chatbot prototype's key characteristics and its limitations.

By the end of this chapter, I designed and implemented a rule-based, system-led, human-scripted chatbot prototype as a "proof of concept" to be used in a Wizard of Oz study. This chatbot prototype is used to showcase design concepts and test approaches that might be potentially helpful in addressing Chinese students' problems in accessing healthcare services. The chatbot prototype is not a finished, fine-tuned, deployable artefact, but rather an experimental instrument to further explore the design space of chatbots in supporting students' healthcare service utilisation. This chapter, together with Chapter 6, answers the third research question listed in Chapter 1, "Can we use a chatbot to positively impact Chinese overseas students' willingness to access healthcare services in the UK?".

## 7.2 Chatbot Content Design

### 7.2.1 User Personas

In Chapter 6 (Section 6.5.3, Table 6.8), I identified a list of problems in students' healthcare journeys, such as having difficulties registering with GPs, being unfamiliar with UK medications, encountering communication problems, etc. In this chapter, I grouped these problems according to target users and their associated context use of the chatbot. Personas were created based on the results in Chapter 6, specifically Sections 6.4.2, 6.4.3, 6.4.4 and 6.5.3.

I chose to use personas to contextualise users' pain points and their needs. Personas were also used to differentiate different sets of pain points and needs. The outcome of this is 3 distinct personas based on the level of acculturation in the UK. Persona A represents new students, i.e., Chinese students who have just arrived in the UK. Persona B represents adapting students, i.e., Chinese students who have been in the UK for some time. Persona C represents acculturated students, i.e., Chinese students who have been in the UK for a long time (3 years or above). It is assumed that Chinese students will engage with some of the healthcare services as their time in the UK increases, and they will become more familiarised themselves with the healthcare services that they have been using. However, they may still not be familiar with the healthcare services that they have not used before. This means one student may have the pain points and needs of more than one persona.

I chose to use the level of acculturation to distinguish personas because students with different acculturation levels may encounter different sets of problems. Studies have shown that Chinese overseas students will face practical, sociocultural and psychological challenges as they initially arrive in the host country (D. Wang, 2017). However, as students live in the host society, they will become more independent in resolving challenges (Z. Li, 2016). Specific to healthcare service utilisation, this implies that new students and acculturated students face different problems. For example, since new students have just arrived in the UK, they may be more likely to encounter practical problems such as registering with the GP, booking appointments, and accessing medications. While acculturated students may already have some experience with UK services, they are more likely to be concerned about the quality of the service. For example, they may feel undervalued as GPs do not offer detailed examinations, and they may distrust GPs as they only give superficial medical advice.

The details of the personas are described in Tables 7.1, 7.2, and 7.3. Each persona covers the user's characteristics, healthcare service utilisation scenarios, user wants, and possible chatbot designs (requirements). Contents were cross-referenced with corresponding findings in Chapter 6.



Table 7.1 Persona A: Persona of the new student

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
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| <p><b>About A:</b></p> <p>She is not familiar with the UK healthcare services and how to use them (Section 6.4.2.2). She lives alone, so there are not many friends around her. She believes that her body is robust, and she can take care of herself. She does not want to put herself in unfamiliar situations, such as going to the doctor because she does not know what to expect from the doctors (Section 6.4.3.5). When ill, she prefers to use medications which she brought from China. She was not familiar with UK medications (Section 6.4.2.6). If possible, she prefers to borrow TCM medications from others as she is familiar with those medications.</p> |
| <p><b>Impression about NHS:</b></p> <p>"I don't know much about the NHS except I know that it has something to do with health. I have just registered the GP, but I never used it, and nobody talks about how it might be different from Chinese hospitals." (Section 6.4.2.2)</p>                                                                                                                                                                                                                                                                                                                                                                                           |
| <p><b>Personal characteristics:</b></p> <ul style="list-style-type: none"> <li>• Gender: Female</li> <li>• Age: 23</li> <li>• Study: MSc Computer science</li> <li>• Communication skills: CEFR B2, able to use English for daily activities. She worried that she cannot understand medical terms and concepts in English during doctor's consultation</li> <li>• Time lived in the UK: 5 month</li> </ul>                                                                                                                                                                                                                                                                  |
| <p><b>Possible healthcare service engagement context:</b></p> <ul style="list-style-type: none"> <li>• Registering with a GP (Section 6.4.2.1)</li> <li>• Booking an appointment with the GP for minor problems (Section 6.4.2.5)</li> <li>• Purchase and use of UK medications (Section 6.4.2.6)</li> <li>• Consulting for minor problems (Section 6.4.2.5)</li> <li>• Getting others for help in urgent situations (Section 6.4.2.3)</li> </ul>                                                                                                                                                                                                                            |
| <p><b>Problems to be addressed based on the findings:</b></p> <ul style="list-style-type: none"> <li>• Registering a GP can be difficult (Section 6.4.2.1)</li> <li>• Unfamiliar with common UK medications: how to use them and where to access them (Section 6.4.2.6)</li> <li>• Unfamiliar with the UK healthcare services: what they do and how to access (i.e., book appointments with) them, particularly the GP (Section 6.4.2.2)</li> <li>• Not understanding the doctor's advice during the consultation (Section 6.4.2.5)</li> </ul>                                                                                                                               |
| <p><b>User wants:</b></p> <ul style="list-style-type: none"> <li>• Register with a GP successfully</li> <li>• Know how the GP works and when to seek help</li> <li>• Know how to access UK medications</li> <li>• Able to understand the doctor's advice</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                          |
| <p><b>Chatbot requirements:</b></p> <ul style="list-style-type: none"> <li>• A Chatbot that introduces the roles of different NHS services and ways to access them, GPs in particular</li> <li>• A Chatbot that provides information about ways to access UK medications</li> <li>• A "portal" to facilitate administrative matters such as GP registration, booking</li> <li>• A chatbot as a translation tool to facilitate communication in doctor consultations</li> </ul>                                                                                                                                                                                               |

Persona A illustrates a Chinese overseas student who has just arrived in the UK. She does not know what the NHS is, and she has not yet registered with the GP. She can cope with daily conversations in English, but she is not confident enough to talk about healthcare problems and understand doctors' advice. She brought many medications from China as precautions. She does not know about common medications in the UK, even the painkillers which are sold on the shelves. She also does not know ways to access these medications. She does not have any experience with the GP, she does not know what the GP is for, and she does not know how to access it. As a result, she wants to: 1. register with a GP successfully, 2. know the way to access the GP when having minor problems, 3. familiarise UK medications and ways to access them, 4. be confident when talking to the doctor. For design opportunities, she envisioned that chatbots could be used to introduce her to the GP registration and appointment booking process, as well as introduce her to UK medications and ways to access them. The chatbot could also be used as a language helper to introduce and translate medical concepts from English to Chinese. She would like to use the chatbot to introduce her to all kinds of services in the NHS. In this way, she can have a comprehensive understanding of the UK healthcare system. If possible, she also wants to use the chatbot as an "online portal" to contact professionals, such as registering with the GP and booking appointments.

Table 7.2 Persona B: Persona of an Adapting Student

**About B:**

She has some experience visiting the GP but not other services. It takes a lot of time and effort for her to wait and get advice from the GP. She lives in a student dormitory with a lot of other Chinese students. She usually hung out with her friends and helped each other. For minor problems that she has already experienced before, she prefers to ask others for help (they share medications that they brought from China). For unknown problems, she does not hesitate to go to the GP, but she is concerned about the time and effort that she needs to search for information online (Section 6.4.2.7). She is also worried about the risk of having long waiting times and getting useless advice, so she only treats visiting the GP as a "backup" option. During the doctor's consultation, her job is to provide as much information as possible for the doctor to diagnose. She treats GP doctors as professionals and never disagrees with them. She knows that she needs to call 999 in emergencies, but it is difficult for her to distinguish between minor illnesses, urgent illnesses and life-threatening emergencies. (ection 6.4.2.3). She is familiarised with some UK painkillers, but she is not familiar with prescribed medications and the ways to obtain them. She prefers to have TCM medications.

**Impression about NHS:**

"I would like to see a doctor when I am ill, but I am worried about the cost and efficiency of reaching the GP (Section 6.4.3.1). I may have to spend a lot of time and effort to prepare for the consultation, like making sense of the illness. I worried that the GP advised things that I already knew. Also, I am not sure about what I am going to do if I have urgent

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| and emergency conditions, and how I would be treated in these condition situations (Section 6.4.2.3, 6.4.3.5)."                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Personal characteristics:</b> <ul style="list-style-type: none"> <li>• Gender: Female</li> <li>• Age: 25</li> <li>• Study: Masters of Architecture</li> <li>• Communication skills: CEFR C1, can use English fluently in daily activities, but is worried that she cannot express her symptoms and needs precisely during the consultation.</li> <li>• Time lived in the UK: 2 years</li> </ul>                                                                                                                                                                                                                                           |
| <b>Possible healthcare service engagement context:</b> <ul style="list-style-type: none"> <li>• Accessing professional help in urgent situations or emergencies (Section 6.4.2.3)</li> <li>• Communication in GP consultations (Section 6.4.2.5)</li> <li>• Access and use UK-prescribed medications (Section 6.4.2.6)</li> </ul>                                                                                                                                                                                                                                                                                                            |
| <b>Problems to be addressed based on the findings:</b> <ul style="list-style-type: none"> <li>• Unfamiliar with the UK medications: not familiarising with prescribed medications and how to use them (Section 6.4.2.6)</li> <li>• Handling urgent conditions and emergencies: hard to distinguish minor, urgent and emergency conditions and know what to do (Section 6.4.2.2, 6.4.2.3)</li> <li>• Hard to estimate the time, effort, and benefit of visiting the GP because of the potential delays in treatments (Section 6.4.2.1, 6.4.3.5)</li> <li>• Hard to articulate her problems and her needs clearly (Section 6.4.2.5)</li> </ul> |
| <b>User wants:</b> <ul style="list-style-type: none"> <li>• Know how to access UK-prescribed medications and know where to look them up</li> <li>• Familiarise with the urgent and emergency services in the UK</li> <li>• Familiarise with how NHS works, particularly the way GPs process her issues</li> <li>• Able to articulate her needs clearly to the doctor</li> </ul>                                                                                                                                                                                                                                                              |
| <b>Chatbot requirements:</b> <ul style="list-style-type: none"> <li>• A Chatbot that provides information about UK medications, ways to access and how to use them</li> <li>• A Chatbot that provides information about the treatment process, particularly about urgent and emergency conditions</li> <li>• A Chatbot that introduces relevant medical concepts that might come up in the consultation. Also, help her to articulate problems clearly.</li> <li>• A chatbot that can generate treatment plans according to her symptoms, with time estimates</li> </ul>                                                                     |

Persona B illustrates a Chinese overseas student who has been in the UK for about 2 years. She knows the way to access the GP, and she has some experience in contacting the GP to resolve some of her minor health problems. She can communicate in English fluently for daily activities, but she may not understand and be able to use medical terminology precisely. She is familiar with common "on-the-shelf" medications in the UK, but she does not know much about UK-prescribed medications, how to use them and how to access them. Fortunately, she has not yet encountered any urgent problems or emergencies, but she worries that she will not be able to handle health

problems in urgent situations or emergencies, as she does not know what to do in these circumstances. Besides, she worries about not receiving timely treatment from the GP. As a result, she would like to: 1. Be able to articulate her symptoms and her needs precisely so that the GP can understand, 2. Know what to do in urgent conditions or emergencies, and 3. Know about the way GPs process her issues and know about ways to request prescribed medications. For design opportunities, she envisioned that chatbots could be used to train her about what to say when talking to the GP; provide information about UK-prescribed medications; and explain to her the treatment process in urgent care units and emergency departments. If possible, she would like to ask the chatbot to generate treatment plans based on the symptom she described (e.g., given a symptom, the chatbot can tell her what to do, when to do it and how to make it happen).

Table 7.3 Persona C: Persona of an acculturated student

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
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| <p><b>About C:</b></p> <p>He has a lot of experience visiting the GP and has some experience with other NHS services, such as seeing hospital specialists. He uses various techniques to take advantage of the GP, such as exaggerating the condition to receive the doctor's attention. He lives in a rented flat with his roommate. However, he is not familiar with services other than the GP, so he does not know exactly how the treatment will be rolled out for complicated illnesses (Section 6.4.2.2). He has had a chronic illness since he was back in China and continues his treatment in the UK (Section 6.4.2.4, 6.4.3.4). Due to the differences in healthcare practices, his expectation often conflicts with those UK doctors (Section 6.4.3.2), leading him to think that doctors in the UK, especially GPs, are unprofessional (Section 6.4.3.3). He treats NHS as a self-service toolbox (Section 6.4.3.1). However, it is hard for him to know all available treatment options/tools while consulting with the GP (Section 6.4.2.5). He feels that it is hard to challenge the doctor and negotiate alternative treatments (Section 6.4.2.5). He also spends a lot of effort when engaging with multiple departments to resolve conflicting suggestions between them (Sections 6.4.2.1, 6.4.3.1, 6.4.3.4). He is familiar with common medications that are sold in the UK and prescriptions that he is using and how to access them, but he is not familiar with other prescriptions (Section 6.4.2.6).</p> |
| <p><b>Impression about the NHS:</b></p> <p>"My experience with the NHS isn't really good. It's not a problem of communication, but because the NHS is inefficient and the doctors are not professional (Section 6.4.3.4, 6.4.3.2). The NHS is not a system to support you, but rather a toolbox. You have to find them to do things you want. (Section 6.4.3.1) "</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <p><b>Personal characteristics:</b></p> <ul style="list-style-type: none"> <li>• Gender: Male</li> <li>• Age: 27</li> <li>• Study: PhD</li> <li>• Time lived in the UK: 7 years</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

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| <ul style="list-style-type: none"> <li>• Communication skills: CEFR C1, can use English fluently in daily activities, and can understand what the doctor said in most cases, but is not familiar with healthcare contexts beyond GP consultations.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <p><b>Possible healthcare service engagement context:</b></p> <ul style="list-style-type: none"> <li>• GP Consultations: negotiating with the GP (Section 6.4.2.5)</li> <li>• Managing expectations of visiting the GP (Section 6.4.3.2)</li> <li>• Knowing the process of visiting different services (other than GP) (Section 6.4.2.2, 6.4.3.4)</li> </ul>                                                                                                                                                                                                                                                                                                                                             |
| <p><b>Problems to be addressed based on the findings:</b></p> <ul style="list-style-type: none"> <li>• Not trusting the GP (Section 6.4.2.5, 6.4.3.1)</li> <li>• Unhappy about unmet expectations and argues with the GP about her needs. He feels that the doctor does not treat him seriously enough (Section 6.4.2.5, 6.4.3.2)</li> <li>• Is unaware of available treatment options and unsure about how to negotiate with the GP to find out the most suitable treatment plan. (Section 6.4.2.5)</li> <li>• Does not know the process of having specialised and chronic treatment (Section 6.4.3.5), and hard to estimate the time and effort of having such treatment. (Section 6.4.2.2)</li> </ul> |
| <p><b>User wants:</b></p> <ul style="list-style-type: none"> <li>• Familiarise with the roles of different NHS services and how NHS services other than the GP process his issues</li> <li>• Able to persuade the doctor and negotiate with doctors about treatment options</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <p><b>Chatbot requirements:</b></p> <ul style="list-style-type: none"> <li>• A chatbot to inform the responsibilities of all NHS services; therefore helping him to manage expectations</li> <li>• A chatbot that teaches him about negotiation techniques for discussing treatment plans and teaches him about communication tactics to make the doctor treat him seriously</li> </ul>                                                                                                                                                                                                                                                                                                                  |

Persona C illustrates a Chinese overseas student who has been in the UK for a long time. He had a lot of experience attending GP appointments, but he had limited experience using other NHS services to deal with complex health issues. He is not familiar with hospital specialists. He can communicate in English fluently for daily activities, and he can use some medical terminology to articulate the symptoms and express his needs. However, he sometimes finds it hard to negotiate with the doctor. Particularly, he is often unhappy with the GP because they cannot fulfil his need to conduct examinations. He feels that GPs are useless, and he was not being treated seriously enough. In addition, he is not familiarise with healthcare services other than the GP, for example, dentists, opticians, and private doctors and how they work with each other. He wants to: 1. be able to persuade the doctor and negotiate with the doctor about treatment plans, 2. familiarise the roles of healthcare services other than the GP, so that he knows what services are available, how they can help, and how he will be treated when making treatment decisions. For design opportunities, he envisioned that chatbots could be used to teach him about techniques to negotiate with doctors as well as introduce him to healthcare services other than the GP. These

features can help him to make healthcare decisions, specifically, help him to manage expectations of healthcare service utilisation and become informed about all possible treatment options when negotiating with doctors.

### 7.2.2 Designing Chatbot Content

In this section, I describe the process of formulating design specifications from pain points and chatbot requirements from Section 6.5.3 and Personas. This process includes 3 steps: highlighting pain points (PP), deciding the Design Possibilities (DP), and specifying chatbot content requirements. This process is illustrated in Figure 7.1.



Figure 7.1 The process of designing chatbot content. First, highlight the Pain Points (PP) in the 3 personas. Next, highlight and discuss Design Possibilities (DP). Then, derive chatbot contents.

#### 7.2.2.1 Identifying Pain Points in Healthcare Service Utilisations

In Chapter 6 (Section 6.5.3 and Table 6.8), we discovered that students' pain points are in the 3 main groups: "Unfamiliar with UK services" (Group 1), "Insufficient communication skills" (Group 2) and "NHS's internal problems" (Group 3). This is also reflected in Personas A, B, and C.

For "Unfamiliar with UK services", students are not familiar with the NHS's treatment processes and medications. The new student (Persona A) is not familiar with the process for registering and accessing the GP (PP.1) and she hardly knows anything about UK medications (PP.2). The adapting student (Persona B) is familiar with the GP but is concerned about treatments in urgent conditions or emergencies (PP.3). She is familiar with common over the counter medications, but she does not know much about prescribed medications in the UK (PP.4). She also struggles to estimate the amount of time that the GP would take to provide treatments (PP.5). The acculturated student (Persona C) familiarises the way to access prescribed medications. He also familiarises the process of dealing with minor problems and emergencies. However, he is not familiar with services beyond dealing with minor or emergency problems, e.g., he does not know much about hospital specialists (to deal with complex and chronic illnesses), dentists, opticians, and private doctors, what they do, what the treatment looks like and how to access them (PP.6). At the same time, he is often

unhappy with the service quality, thinking it is inefficient and ineffective. He feels that doctors, especially GPs, do not fulfil his expectations (PP.7).

For “Insufficient communication skills”, students expressed different degrees of concern. The new student (Persona A) is able to cope with daily conversations, but unable to cope with any healthcare topics (PP.8). The adapting student (Persona B) can communicate fluently in daily contexts but is unable to understand medical terminologies and articulate problems and needs precisely (PP.9). The acculturated student (Persona C) can communicate fluently to describe healthcare problems but felt difficult to negotiate with doctors to agree on treatment plans and persuade doctors to fulfil his personal needs (PP.10).

For “NHS's internal problems”, students worry about administrative problems such as finding an available GP to register and ways to access and book appointments with the GP when having minor problems (Persona A) (PP.11). In Persona B, because of the potential delays, the student thinks that it can be difficult to estimate the time, effort and what she can get from the GP (PP.12). This also coincides with Persona C, where the student stated that he is unable to predict the time and effort to undertake specialised or chronic treatments in the UK (PP.12).

#### 7.2.2.2 Identifying Design Possibilities

In Chapter 6 (Sections 6.5.1 and 6.5.3), students proposed 5 possibilities for the chatbot for support: 1. as a source of information to answer enquiries (DP.1), 2. as an educational tool for preparing consultations (DP.2), 3. as a patient portal for online interaction with healthcare staff (DP.3), 4. as a translation tool to facilitate consultation communications (DP.4), and 5. as a supportive tool to overcome psychological reluctance (DP.5). In the 3 Personas, the first four Design Possibilities (DP. 1-4) are results of the 3 main causes: “Unfamiliar with UK services”, “Insufficient communication skills”, and “NHS's internal problems” (summarised in Section 6.5.3). The last one is due to individual personalities. Table 7.4 illustrates the association between students’ pain points (PP) and students’ proposals of Design Possibilities (DP) of the chatbot.

Table 7.4 The association of users’ pain points (PP) and proposed Chatbot’s Design Possibilities (DP) (c.f. Section 6.5.3, Table 6.8).

| Students' pain points (PP)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Main groups of difficulties                                                                                                                                                              | Design possibilities (DP)                                                                                                                                                                                                                                                                               |
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| <b>Pain point 1:</b> Unfamiliar with the GP; want to know about the GP<br><b>Pain point 2:</b> Know nothing about UK medications; want to know about medications in the UK and how to access them<br><b>Pain point 3:</b> Know nothing about treatment processes for emergencies; want the chatbot to introduce emergency services<br><b>Pain point 4:</b> Unfamiliar with prescribed medications in the UK, want to know when to use and where to access them<br><b>Pain point 5:</b> Hard to estimate GP's treatment; want to know about time, effort, benefits and for healthcare visit planning<br><b>Pain point 6:</b> Unfamiliar with treatment processes other than GP and emergency services; want to know about when to use them and how to access them<br><b>Pain point 7:</b> Often dissatisfied with services; want to know about the differences between healthcare systems in China and the UK<br><b>Pain point 8:</b> Have difficulty communicating in consultations; want to translate symptoms, needs and advice between 2 languages<br><b>Pain point 9:</b> Hard to understand advice and articulate needs; want the chatbot to help to prepare for medical concepts<br><b>Pain point 10:</b> Disagree with the doctor; want the chatbot to teach him about negotiation techniques to argue with doctors<br><b>Pain point 11:</b> Hard to register and access the GP due to availabilities; want to register and book online<br><b>Pain point 12:</b> Hard to estimate GPs' and specialists' treatment process; want to show an estimation of time for healthcare visit planning | <div> <b>Groups 1:</b> Unfamiliar with UK healthcare services </div> <div> <b>Group 2:</b> Insufficient communication skills </div> <div> <b>Group 3:</b> NHS's internal problems </div> | <div> <b>Option 1:</b><br/>An agent to answer students' enquires </div> <div> <b>Option 2:</b><br/>An educational tool to make sense of services </div> <div> <b>Option 3:</b><br/>A language translator </div> <div> <b>Option 4:</b><br/>A patient portal to interact with healthcare services </div> |

For “Unfamiliar with UK services” (Group 1), the student in Persona A does not know much about UK healthcare services, even GPs (PP.1). She hardly knows anything about UK medications (PP.2). In response to these difficulties, she would like to use the chatbot to introduce her to the GP, e.g., how to register with the GP and how to use it (DP.1). She also wants to use the chatbot to familiarise UK medications and ways to access them (DP.2). In persona B, the student does not know about treatment processes for urgent problems or emergencies (PP.3) and she does not know much about prescribed medications (PP.4). She also finds it difficult to estimate the time that



it takes for the GP to resolve her problem (PP.5). To address these problems, she would like the chatbot to introduce her to emergency services, e.g., when to use them, how to use them, and what the process will look like (DP.2); she wants to use the chatbot to familiarise prescribed medications (DP.1). If possible, she would like the chatbot to help her to plan treatments based on her symptom and personal circumstance. For example, ask the chatbot to generate a treatment plan that takes the least time to relieve the discomfort or to generate a plan that examines the condition thoroughly with time estimates (DP.1). In persona C, the student is not familiar with healthcare services other than the GP and emergency department. He does not know much about specialist doctors, what they are for and how to access them (PP.6). He would like to use the chatbot to help him understand the roles of different NHS services and their treatment processes (DP.2). In addition, the student is often dissatisfied with the service quality, as he feels that NHS is being inefficient and ineffective. He has to wait for a long time to be seen, and the doctor does not always offer what he wants (PP.7). For example, he wants to have prescribed medications, while the doctor only conducts simplistic checks and gives useless advice. As a result, he proposes to use the chatbot to help him manage expectations (DP.2). For example, rather than assuming that the treatment process will be the same in China, he would ask the chatbot to learn about the differences in diagnosis processes and outcomes between China and the UK. In this way, the chatbot “re-calibrates” his expectancies.

For “Insufficient communication skills” (Group 2), the student in persona A only able to cope with daily conversations, she finds it difficult to understand and speak about healthcare-related topics in English (PP.8). Therefore, she wants the chatbot to translate her symptoms, her needs as well as the doctor’s advice (DP.3). In persona B, the student experiences difficulties in understanding and articulating needs because of the unfamiliarity of medical terminologies. She wants the chatbot to help her prepare for medical concepts and articulate needs so that she can use these terms confidently in consultations (DP.2). In persona C, the student is often dissatisfied with the treatment process. He finds that doctors do not always fulfil his needs despite describing symptoms clearly (PP.10). Hence, he would ask the chatbot to teach him about communication techniques that can be used in doctor consultations. He expects that he can comfortably argue with the doctor after he prepares with the chatbot (DP.2).

For “NHS's internal problems” (Group 3), students wish to use the chatbot as an online patient portal, i.e., a tunnel to contact NHS staff to deal with their problems. Students want to use the patient portal to 1. Facilitate accessing healthcare services, 2. Detail the steps of the treatment process. Persona A experienced difficulties in finding an available GP to register. Thus, she would like to use an online portal to register for the GP. She is also worried about having trouble accessing the GP (e.g. availability problems) (PP.11), so she would like to book GP consultations online (DP.4). In persona B, the student finds it difficult to estimate the time and effort for visiting the GP.

Similarly, in persona C, the student does not know about the time and steps for carrying out specialised or chronic treatments (PP.12). Thus, it would be beneficial if the portal could display details of treatment steps for them to estimate and make sense (DE.4).

### 7.2.2.3 Choosing What to Design

I decided to focus on implementing DP.2 in our chatbot prototype, i.e., using the chatbot as an educational tool for making sense of services and preparing for consultations. This is because of the following reasons (see Table 7.4): 1. DP.2 can address many unfamiliarity-associated problems and communication-associated problems; 2. DP.2 can be implemented as a prototype given practical constraints; 3. DP.2 does not overlap with existing forms of technology.

Implementing the prototype in the form of an educational tool allows us to address many students' pain points. Table 7.4 shows that DP.2 covers both unfamiliarity-associated problems and communication-associated problems. For unfamiliarity-associated problems, the "educational" chatbot may provide students with relevant materials. For example, introduce them to different healthcare services, such as the GP (PP.1), the urgent care unit (PP.3), as well as other services. Further, the chatbot may explain treatment processes to the student, e.g., treatment procedures, times involved, and potential outcomes of accessing a service (PP.5, PP.6 and PP.7). The chatbot may also introduce students to medications in the UK, such as different types of medications and ways to access them (PP.2 and PP.4). For communication-associated problems, the educational chatbot may suggest relevant medical concepts and help the student to prepare articulation of needs before consultations (PP.9). The educational chatbot may also teach the student some negotiation tips when they disagree with doctors (PP.10).

Another reason to implement the prototype as an educational tool is that it is relatively easy to implement. In Chapter 6 (Section 6.5.3) and 3 Personas, students wish the chatbot artefact to have some degree of intelligence to answer their questions (PP.1). They hope that the chatbot could understand their symptoms and thus generate treatment plans (i.e., instruct them what to do) and medication recommendations. However, implementing such degrees of intelligence requires advanced machine-learning algorithms, a large amount of medical data for training, and a vast amount of computational power. These resource requirements are beyond the scope of this project. Even if this is implementable, it is still potentially harmful to the user if the wrong advice is given. It is rather hard to regulate a chatbot with intelligence due to the "black-box nature of machine-learning algorithms (c.f. Section 3.2.1). Embedding intelligence into the chatbot requires careful ethical considerations and cautious validation of the technology. Another popular proposal is to use the chatbot artefact

as an “online portal” to contact NHS staff and healthcare professionals, such as registering the GP booking appointments, checking availabilities and giving time estimates (DP.4). Although this kind of proposal reflects students’ desire to access and use healthcare services online, this kind of application requires the chatbot artefact to link to GPs’ or NHS’s internal systems. This is also beyond the scope of this project due to the lack of gatekeepers.

In Chapter 6 (Section 6.5.3) and three Personas, students proposed chatbot functionalities which overlap with existing technologies. Students hope to use the chatbot for translation during consultations. However, this function has already been implemented in commercial apps such as Google Translate and Apple Translate. Students can use them when they encounter terminology problems. Given resource constraints and ethical considerations, we decided to keep the chatbot as simple as possible so that it can be easily implemented and evaluated. Therefore, we decided to choose DP.2, the educational chatbot, as our implementation of the chatbot prototype.

To implement DP.2, I imagine the chatbot will be able to introduce students to materials about problems that they have been concerned about. Students can prepare for healthcare service utilisation by reading the pre-written content and asking follow-up questions about their concerns. In this way, students may be more familiar with the UK healthcare system and medications (PP. 1 to 7) and may be more confident in communicating with doctors (PP. 9 and 10).

#### **7.2.2.4 Specifying Chatbot Contents to Implement**

The chatbot content specifications are listed in Table 7.5. Specifications are derived from pain points (PP) that can be addressed by Design Possibilities 2 (DP.2), i.e., chatbot as an educational tool in Table 7.4.

| Chatbot specifications                                                                                                                                         | User wants that associated with specifications                                     | Ways to help                                                                                               | Ways to help reflected in chatbot scenario |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|--------------------------------------------|
| <b>Specification 1:</b><br>Chatbot should provide an overview of the UK healthcare system, explaining the roles and responsibilities of different NHS services | <b>Want 1:</b> Want to know about GP                                               | Introduce the student to the GP: what they do and how to use them                                          |                                            |
|                                                                                                                                                                | <b>Want 3:</b> Want to know about emergency services                               | Introduce the student to emergency services: what they do and when to use them                             |                                            |
|                                                                                                                                                                | <b>Want 6:</b> Want to know about other health services in the UK                  | Give an overview of all common health services in the UK: what they do                                     |                                            |
| <b>Specification 2:</b><br>Chatbot should introduce students to UK medications, and ways to access medications                                                 | <b>Want 2:</b> Want to know about common UK medications                            | Introduce the student to the types of medications in the UK and ways to buy them                           |                                            |
|                                                                                                                                                                | <b>Want 4:</b> Want to know about prescribed medications in the UK                 | Introduce the student to prescribed medications and ways to access them                                    |                                            |
|                                                                                                                                                                | <b>Want 5:</b> Want to know about the UK treatment processes                       | Explain treatment processes to the student, including treatments for minor, chronic, and urgent conditions |                                            |
| <b>Specification 3:</b><br>Chatbot should introduce students to treatment processes                                                                            | <b>Want 7:</b> Want to have a realistic expectation of what the UK services can do | Highlight key differences between China and the UK                                                         |                                            |
|                                                                                                                                                                | <b>Want 9:</b> Want to help with articulating needs                                | Help the student to think about what to say in the consultation                                            |                                            |
|                                                                                                                                                                | <b>Want 10:</b> Want to persuade doctors                                           | Introduce the student to tips for negotiation                                                              |                                            |
| <b>Specification 4:</b><br>Chatbot should address students' concerns about communication in consultations                                                      |                                                                                    |                                                                                                            |                                            |

Table 7.5 Chatbot specifications and ways to help. The chatbot specifications are derived from students' pain points (Table 7.4). I formed 4 distinct scenarios of dialogue scripts based on different service-use contexts (i.e., use case scenarios). Each use case scenario focused on one aspect of UK healthcare services: services overview, pharmacies & medications, urgent care services, and GPs. Each chatbot scenario is designed to fulfil a portion of users' pain points.

**Specification 1** provides students with an overview of the healthcare system in the UK. By showing students what different services do and when to use them, I imagine that students will have a better understanding of all kinds of healthcare services in the UK. Given a medical condition, they will know what the most appropriate type of service is to use. This specification is implemented as a distinctive chatbot use-case scenario, where the student is almost completely unfamiliar with the UK healthcare system and would like to use the chatbot to familiarise the UK system (Scenario 1 in Table 7.5).

**Specification 2** is targeted at addressing problems that are associated with UK medications. The chatbot will help the student distinguish between non-prescribed and prescribed medications while also clarifying the ways to access them. We imagine that when students have minor illnesses, they should know what kind of medicine they need and they should know to acquire it. Same as Specification 1, this specification is implemented as a distinctive chatbot use-case scenario, where the student wants to get prepared for minor illnesses and wants to use the chatbot to familiarise UK medications (Scenario 2 in Table 7.5).

**Specification 3** aims to address problems that are linked to the treatment processes of different healthcare services. The chatbot will explain the treatment steps involved in the service, such as steps to access the service, procedures of consultation and intervention, as well as potential outcomes. We aim to provide the student with a clearer understanding of what treatments look like in the UK. After reading chatbot materials, they should be aware of the differences in treatments between China and the UK, and they can plan their treatments realistically. This specification comprises two components. One is to provide detailed information about the treatment processes of different healthcare services. The other one is to highlight differences in treatments between China and the UK. The former is implemented as Scenario 3 and Scenario 4, where the student wants to understand the treatment process for handling emergencies (Emergency Department) and resolving minor, chronic illnesses (GP). The latter is covered in Scenarios 1, 2, 3 and 4 where the chatbot explains the differences in organisations, medications, emergency services and primary care services between China and the UK.

**Specification 4** is proposed to mitigate difficulties in consultation communications. The chatbot will help the student to think about what to say before the consultation and give pointers on medical terminology. The chatbot will also offer suggestions on how

to handle situations where they disagree with doctors. In this way, the student should be more confident when speaking to doctors. This specification is covered in Scenarios 2, 3, and 4, as supplementary content when explaining processes of accessing medications (Scenario 2), handling emergencies (Scenario 3) and resolving minor, chronic illnesses (Scenario 4). This is because different services have different contexts of communication. It is rare to disagree with doctors in emergencies, but more common in minor or chronic consultations.

## 7.3 Chatbot Prototype Implementation

### 7.3.1 Interacting with Users

Our implementation of the chatbot prototype is a web-based application. It is hosted using the Facebook Page service. The reason I used the Facebook platform is that Facebook provides a standard, built-in web-based user interface (i.e., front end) for messaging and texting (i.e., Facebook Messenger). Also, the interface can easily connect to the chatbot prototype's backend through pre-defined APIs. Although I recognise that Chinese students may not use Facebook regularly, I only used it as an instrument for experiments. Students should be familiar with the interface as it is similar to popular social media platforms used in China (e.g. WeChat).

Students can interact with the chatbot by logging into a Facebook account from a web browser. Once logged in, they can send messages via Facebook Messenger to the chatbot's Facebook Page (namely "Helping Chinese overseas students to access UK healthcare services"). Once the chatbot prototype receives a message from the user, it will initialise the conversation and send the user a greeting message to start the conversation. An example of the conversation initialisation is illustrated in Figure 7.2.

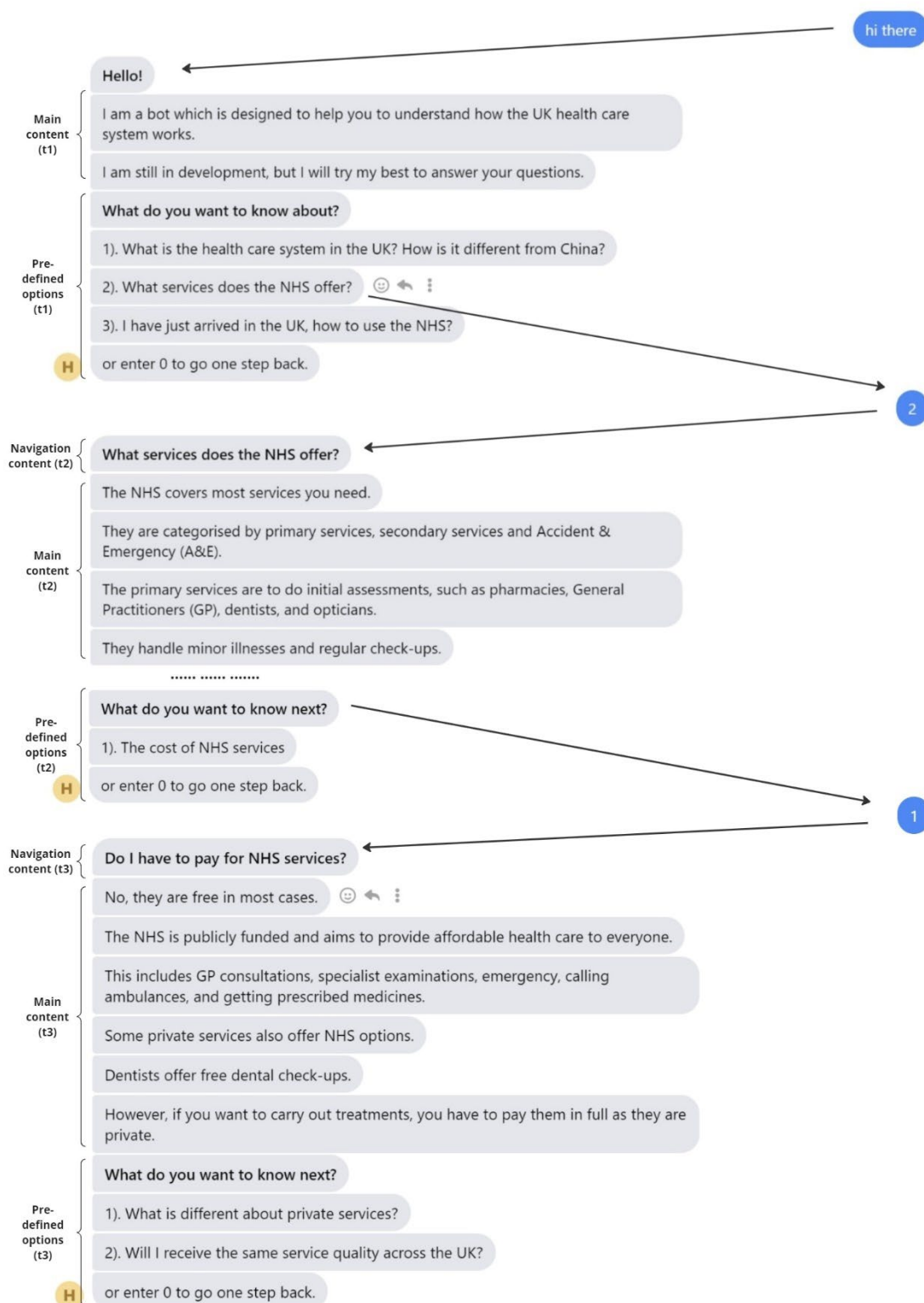


Figure 7.2 A screenshot of the start of a conversation. The user starts a conversation by typing "Hi there". Then, the chatbot initialises the dialogue manager (in the backend) and introduces itself to the user (indicated by the first arrow). Then the user can explore the content following the "pre-defined" options (indicated by the second group of arrows).

After an initial message from the user (e.g., “Hi there”), the chatbot gives a short greeting and informs the user of its purpose (see the Main content (t1) in Figure 7.2). The chatbot then asks what the user would like to know about, given several pre-defined topics (see the Pre-defined questions (t1) in Figure 7.2). The conversation moves to the next turn after the user has chosen a topic (e.g., the user entered “2” in the case to learn about what kind of services the NHS have).

In response to the user’s input, the chatbot displays a message to signify the change in the topic (see Navigation content (t2) in Figure 7.2) and presents the main body of the content that the user has chosen (see Main content (t2) in Figure 7.2). At the end of the main content, the chatbot displays a list of follow-up topics that the user can choose (Pre-defined questions (t2) in Figure 7.2). If the user decides to explore further on a follow-up topic, the chatbot will present the contents of that follow-up topic (see Navigation content (t3) and Main content (t3) in Figure 7.2) to continue the conversation. If the user is not interested in any of the follow-up topics, the user may choose to explore topics that have been displayed in the previous turn by entering 0 and then entering the corresponding sequence number of that topic to continue the conversation (e.g., if the user is at the second turn and wants to explore “healthcare system in the UK”, they can enter 0 to move one step (turn) back and then enter 1 to explore the main content of the topic “healthcare system in the UK”).

The conversation of each scenario typically consists of several turns. At the start of each conversational turn, the chatbot presents the navigation message and the main content that the user has chosen from the previous turn. At the end of each conversational turn, the chatbot displays some pre-defined options for the user to choose from and waits for the user’s input (see turn 2 and turn 3 in Figure 7.2).

Once the chatbot has displayed all the follow-up contents of a given topic, the chatbot will ask the user if they want to end the conversation (see Pre-defined option (t0)) in Figure 7.3). The user can either go back to the previous turn to explore other follow-up topics, or the user can choose to end the conversation. If the user chooses to end the conversation, the chatbot will give a summary of the scenario. Figure 7.3 illustrates an example of a conversation at the ending phase. The scenario in this figure introduces students to the healthcare system in the UK. After the user decides to end the conversation, the chatbot gives a summary of key points of what the user has learned (see Navigation content (t1) and Main content (t1) in Figure 7.3) and terminates the conversation in the backend. At this stage, the user can restart the entire conversation again (see Pre-defined options (t1) in Figure 7.3), and the chatbot will greet the user with the list of pre-defined topics (see Main content (t1) and Pre-defined options (t1) in Figure 7.2). Alternatively, if the user has an unanswered question, they may be allowed to ask that question to the chatbot (see Pre-defined options t1: type a question). The chatbot will try to answer the question, but not guaranteed to provide a definitive answer (see the Navigation content (t2) and Main



content (t2) in Figure 7.3). Behind the scenes, the user's question is read by another person, and the question is answered manually in real time.

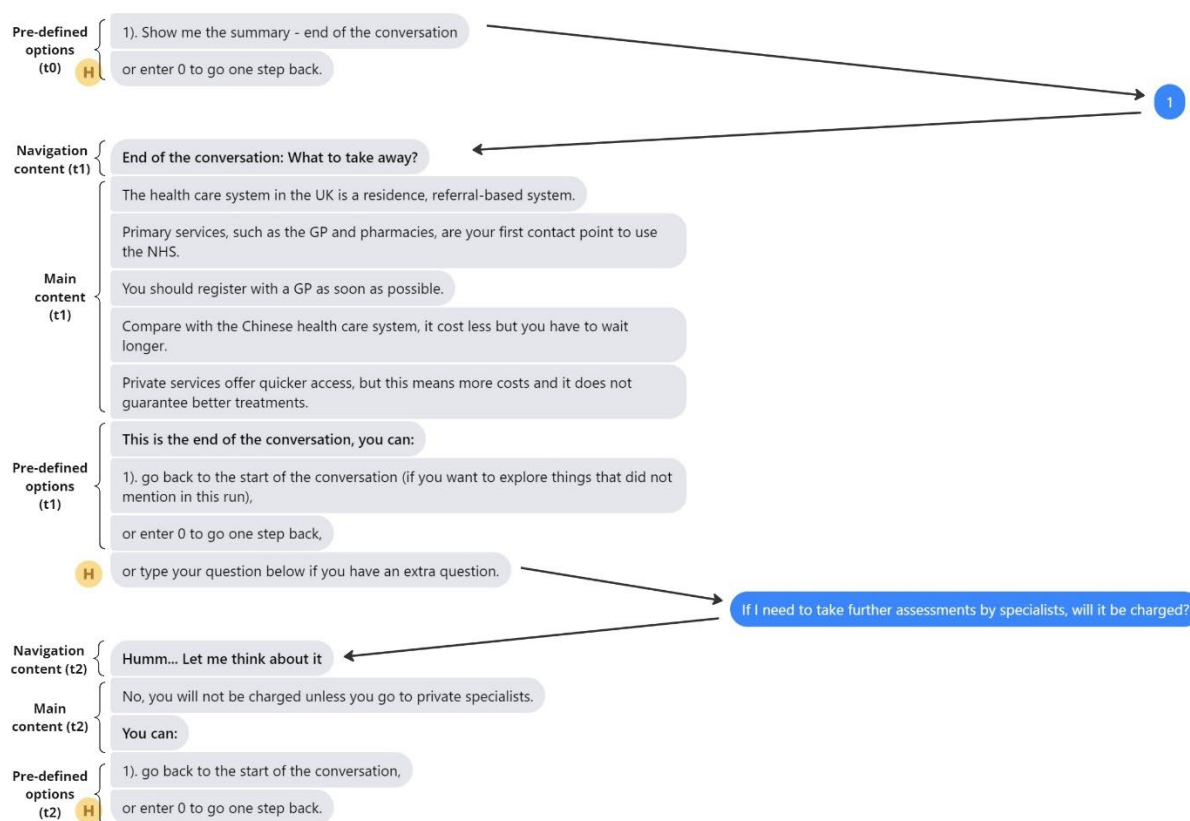


Figure 7.3 A screenshot of ending a conversation. After the chatbot displays all contents of a given topic, it will ask the user if they want to end the conversation. If the user chooses to do so (indicated by the first group of arrows), the chatbot will provide the user with a summary of the use case scenario (in this case, the UK healthcare system) and terminate the dialogue manager (in the backend). Then, the chatbot will ask if the user has further questions. The user can freely ask one question (indicated by the second group of arrows), and the chatbot will attempt to answer it.

### 7.3.2 Implementation and Rationale

Our chatbot interaction is mainly led by the chatbot. At the start of the conversation, the chatbot asks the user to choose from a list of topics to explore. During the conversation, the chatbot continuously displays lists of follow-up topics and options for the user to choose from. The user follows the chatbot's guidance and reads pre-written materials to complete the conversation. Only at the end of the conversation, the user may ask an open question to the chatbot, which is answered by a human behind the scenes. When interacting with the chatbot, the user chooses what to read rather than thinking about what to ask. The chatbot is implemented in the form of a turn-based, rule-driven, human-interventional dialogue management system. During

the conversation, both the user's inputs and the chatbot's responses are automatically stored in a local database for further investigation.

We used the Finite State Machine (FSM) approach to model conversations. The FSM computational model is widely used in the field of natural language processing to control the flow of conversations. It consists of a finite number of states, a set of transitions between states and the associated transition rules. Each state in the FSM represents a conversational turn in the conversation. The FSM models the dialogue as follows: First, the FSM outputs the dialogue content of that state and waits for the user to respond. Once the user sends a message to the chatbot, the FSM looks at the user's input and decides which state to move to based on the transition rules. The FSM help to manage the dialogue flow by defining all possible paths and actions at each conversational turn.

Many studies used the FSM approach to model conversational interactions. The ELIZA (Weizenbaum, 1966), an early implementation of the chatbot for psychotherapy, used FSM to manage user inputs and system responses. This approach has also been successfully applied in other fields such as customer support (P. Nielsen & Baekgaard, 1992), language tutoring (Rose et al., 2003), tourism (Hori et al., 2008) and general query-answering (Fast et al., 2018). Also, various tools were developed to build FSM and its variants to model dialogue interactions (Larsson & Traum, 2000; M. F. McTear, 1998; Pietquin & Dutoit, 2003).

Compared to dialogue systems such as frame-based and agent-based systems (e.g., Siri, ChatGPT), which allow more flexible user inputs, the FSM's turn-based, rule-driven approach only allows limited user inputs, as FSMs recognise only pre-defined inputs. However, this may not necessarily reduce user experience if designed properly (Yi & Jung, 2017). We claimed that the FSM approach fits our use context with many advantages. The first is simplicity. The FSM approach provides a simple and intuitive way to model conversations. It does not require a lot of data and computational power to generate meaningful content. All dialogue is human-crafted. In our case, healthcare materials should come from trustworthy sources and need to be examined by humans to ensure their correctness. It may be hard for machine-learning-based systems to verify all their training data. The second reason is that the FSM approach is inherently suited to model structured conversations, e.g., menu-driven interactions or guided conversations. This fits our use context because educational dialogue materials are also structured. We want to educate the user step by step, in a progressive order, to unfold healthcare services in the UK. The user does not have to think about what to ask at the start of the conversation. Another advantage is the ease of modification. In FSM, each state represents a specific chunk of the conversation, and all transitions are defined explicitly. It is easy to change the dialogue content in each state or change the rule of transitions between 2 states without affecting other components in the

conversation. This modularity makes it possible to adjust dialogue contents quickly based on users' feedback.

To mitigate the inflexibility problem caused by the FSM, I added a distinctive human-intervention state in our implementation. At the end of the conversation, the FSM enters this state and asks the user if they want to ask open questions. After the user enters the question, the FSM transfers the user's question to a wizard who operates behind the chatbot, allowing the wizard to provide the answer.

### 7.3.3 The Chatbot Implementation Process

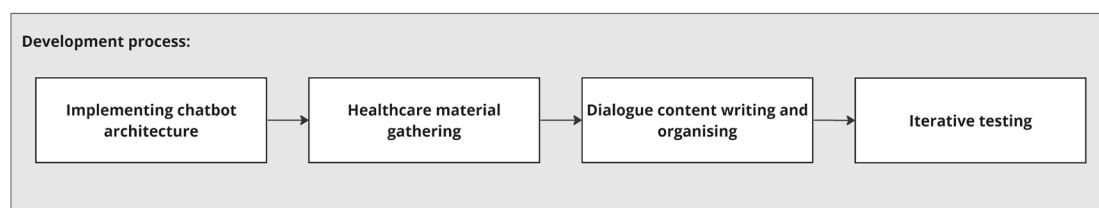


Figure 7.4 The implementation process of the chatbot prototype. It consists of 4 stages: implementing the chatbot architecture, gathering materials about UK healthcare, writing and organising dialogue scripts, and iterative tuning.

The implementation consists of 4 steps: chatbot architecture implementation, healthcare material gathering, dialogue content writing and organising, and iterative testing. The idea is to implement a working chatbot that is enough to run the Wizard of Oz experiment and improve it iteratively through user testing.

**Architecture implementation:** The implemented chatbot has 3 components: the dialogue manager, the chat interface and the web back end. The dialogue manager decides what to generate based on the user input. This is modelled by an FSM where each state represents a chunk of the healthcare material (e.g., main content in Figures 7.2 & 7.3) with a list of follow-up options to explore (e.g., predefined options in Figures 7.2 & 7.3). The FSM is implemented in Python programming language (*Python.org*, 2023). The chat interface handles user inputs and displays the chatbot's outputs. This is implemented using Facebook Messenger's (*Messenger Developer Tools*, 2023) pre-existing interface. The web back-end processes user inputs and the chatbot's outputs as web requests. This is implemented using the Flask framework (*Flask*, 2023).

**Material gathering:** We performed a healthcare material search to build the 4 use case scenarios. Materials were collected from 3 trustworthy online sources: NHS England (*NHS England*, 2023a), NHS Scotland (*NHS Scotland*, 2023) and Healthtalk.org (*Healthtalk*, 2023), an academically verified healthcare story-sharing website hosted by the Dipex Charity in partnership with the Health Experiences Research Group at the University of Oxford. Dialogue materials were chosen based on the specifications and ways to help that are listed in Table 7.5.

**Writing and organising:** For each use case scenario, the dialogue content was first written in the form of an article following the structure of the introduction, main body, and closing sentences. The content was written by a single researcher in Microsoft Word based on the healthcare materials collected in the previous step. Then, the written content is reviewed and discussed to divide the article into clusters of paragraphs. Each paragraph has a key topic and contains around 3 to 5 sentences to make the content more conversational. After that, these paragraphs are used as building blocks to design the dialogue flow. The discussion, clustering and flow designing were undertaken by two researchers on an online collaborative whiteboard tool, Miro. At the end of this stage, I built 4 “trees of contents” in response to the 4 use case scenarios and merged them into the FSM (Appendix D2).

**Iterative testing:** After the previous steps, I had an operational chatbot. However, it has not been tested. In this step, I aimed to 1. check if the chatbot behaves as expected (i.e., debugging), 2. check if dialogue contents are coherent with no errors or mistakes, 3. check if the dialogue contents are comprehensible, and 4. identify any issues in usability, such as error recovery, easy to read and interact. We had a 3 testing. In the first cycle, I invited one native English speaker to go through all the contents of the 4 use case scenarios to examine if there were irrelevant or confusing statements (Figure 7.5, left). In the second cycle, I asked 2 Chinese students to try out the chatbot freely to check if they understood the dialogue contents and spot any usability issues (Figure 7.5, right). In the third cycle, I invited another 2 Chinese students to participate in pilot trials of the Wizard of Oz experiment. Participants were asked to perform the same set of tasks as those expected to be carried out in the formal experiment to identify any flaws in the chatbot system. Many suggestions were given at this stage, such as spotting grammar mistakes (in the first cycle), adding navigation sentences (in the second cycle), using bullet points to shorten dialogue contents (in the second cycle) and helping to discover bugs in response to free user inputs (in the third cycle).

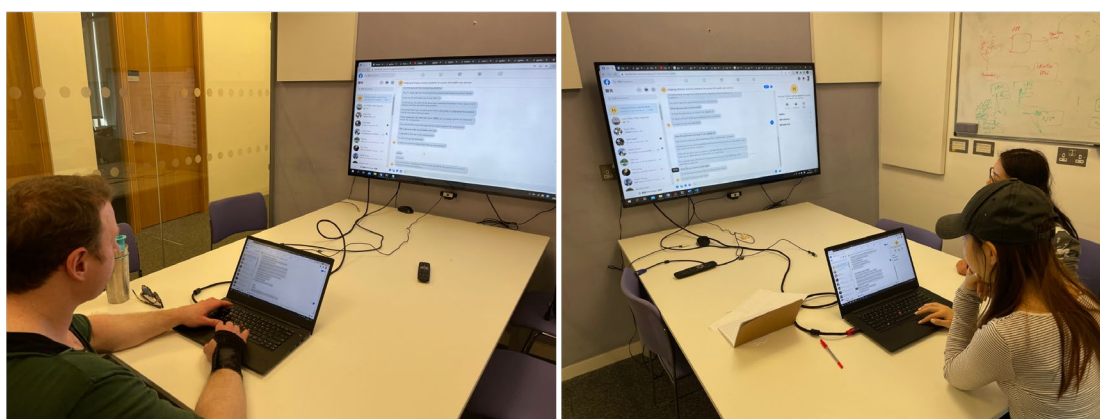


Figure 7.5 Photographs taken from the iterative testing process. Native English speakers (photo on the left) were asked to go through the 4 scenarios to spot grammar mistakes and confusing

statements. Chinese students (photo on the right) were asked to go through the 4 scenarios for sense checking and play around with the chatbot to test its usability.

## 7.4 Implementation Details

Section 5.3 describes the chatbot's interaction behaviour and its development process. In this section, I document the details of the implementation. This includes details of the chatbot components (i.e., the architecture), how the user interacts with the chatbot, how the chatbot components interact internally, and how dialogue management behaves.

### 7.4.1 Information Architecture

The information architecture of the chatbot can be divided into 2 parts: the front end, which displays messages and captures user inputs; the back end, which processes user inputs and generates chatbot responses and logs messages into the database. Figure 7.6 illustrates the information architecture of the chatbot prototype.

For the front end, I used the Messenger web interface as the chatbot's dialogue interface (*Messenger Developer Tools*, 2023). The dialogue interface is shown in Figures 7.2 and 7.3. At the bottom of the browser, chatbox. All messages are shown inside the grey and blue "bubbles" (chatbot response and user input respectively). Message from the user can either be pre-defined options or free input text depending on the stage of the conversation; whereas messages from the chatbot have 3 components: the navigation sentence, which signifies the beginning of a new topic; the main content, which presents educational materials; and the list of pre-defined options that the user may explore for the next turn.

The data exchange between the front and the back end is implemented using the HTTP protocol over TLS/SSL (i.e., HTTP). Messages from both ends are formatted in JSON format (a type of data structure) according to Messenger's APIs (*Messenger Developer Tools*, 2023). Data is wrapped and unwrapped by using the Pymessenger package (Pymessenger, 2016).

For the back end, I used Python programming language (*Python.org*, 2023) and the Flask web framework (*Flask*, 2023) to implement the chatbot. The back end handles 3 things: decides the chatbot's response (i.e., the dialogue manager), logs dialogue messages (i.e., log storage), and sends the chatbot response to the front end. The response sending, as mentioned previously, is handled by Flask and the Pymessenger package.

The dialogue manager is implemented in the form of a Finite State Machine (FSM), where a conversational turn is modelled by a state (FSM's definition and design

rationale are described in Section 7.3.2, and its behavioural detail is described in Section 7.4.2.2). Each state includes a state ID, the navigation sentence, the main dialogue content and the list of pre-defined options. Figure 7.7 illustrates the content included in an individual state. The content of this state is also shown in Figure 7.2 as a conversational turn in the front end (see navigation content, main content and pre-defined option in t3). Typically, there are around 15 states in one use-case scenario, and all states are stored in a corpus file to be loaded by the dialogue manager. The back end also logs the conversation automatically. At the end of each conversation turn, the back end will store the user input message, the chatbot response (the state ID, navigation sentence, main content, pre-defined options) and the request sending timestamp into an SQLite database (*SQLite Home Page*, 2023). These records will be used to analyse the interaction behaviour of participants in the Wizard of Oz experiment.

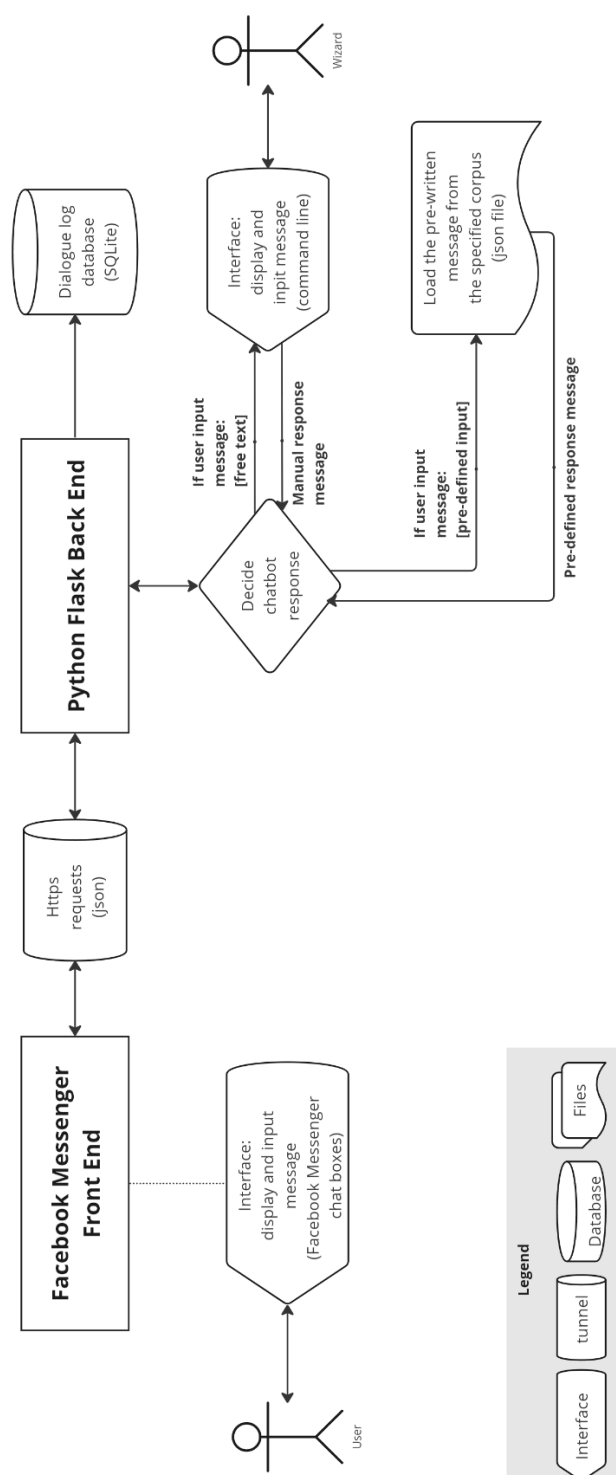


Figure 7.6 Information architecture of the chatbot implementation. It has 2 parts: the front end and the back end. The front end handles what the user sees and user inputs. The back end handles what to respond to and logs dialogue interactions. The data exchange between the front and back ends is implemented using HTTP protocol.

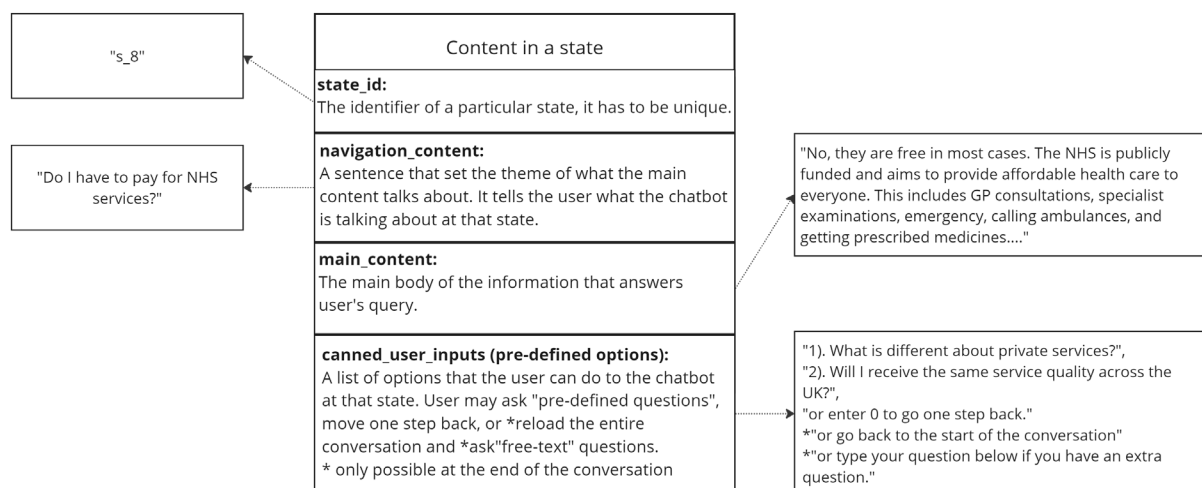


Figure 7.7 The contents in each state of a conversational turn. It includes a state ID, the navigation sentence, the main dialogue content and the list of pre-defined options. The example corresponds to turn 3, "Do I have to pay for NHS services?" of the conversation in Figure 7.2. Options with astral marks only appear in the human-intervention state at the end of the conversation (see section 7.3.3).

## 7.4.2 Dialogue Interaction and Management

### 7.4.2.1 Chatbot-user interaction

Figure 7.8 uses the UML interaction diagram (Bell, 2003) to demonstrate the interaction between the user and the chatbot, and how different components inside the chatbot interact internally. While the user sends messages from the front end of the chatbot, the components in the back end: the Flask-FSM, the corpus, the database and the human wizard work together to generate corresponding chatbot responses.

Before the user interacts with the chatbot, the wizard has to specify the use case scenario to the Flask backend. The Flask backend loads the dialogue content and transition rules of the use case scenario from the corresponding corpus file. After this step, the dialogue manager is activated and waits to process user inputs. This part of the interaction is illustrated as "Initialise: load a specified corpus" in Figure 7.8.

When the user enters a pre-defined option to explore follow-up contents, the Messenger forwards the user inputs to the Flask back end. Then, the back end performs the following actions: 1. Show the user's input message to the human wizard; 2. Recognise the user's input, choose the chatbot response based on the transition rules and the current state of the FSM, and load the corresponding dialogue content from the corpus file; 3. Log the user's input message, the corresponding chatbot response and the state transition to the database, along with a unique timestamp; 4.



Sends the chosen chatbot response to the front end. Once the front end receives the HTTP request from the back end, it displays the chatbot response message in the Messenger interface for the user to read. This part of the interaction is illustrated as “Dialogue and system interaction when the user enters a pre-defined input” in Figure 7.8.

At the end of the conversation, the chatbot will ask the user whether they want to ask open questions (see Figure 7.3, main content t1 and t2). If the user chooses to do so and enters a free-text message, then the dialogue manager will receive the message from the front end and present the message to the human wizard. After it recognises that the user’s message is in free-text form, the dialogue manager moves the current state of the FSM to the dedicated “human state” and prompts the human wizard to respond to the user’s message manually (detail is described in Section 7.4.2.2). Once the human wizard enters an answer to the user’s question, the back end stores the user’s message, the wizard’s response and the state transition to the database and forwards the human-written response to the front end. The front end then unpacks the backend’s response and shows it to the user. This part of the interaction is illustrated as “Dialogue and system interaction when the user enters a free input” in Figure 7.8.

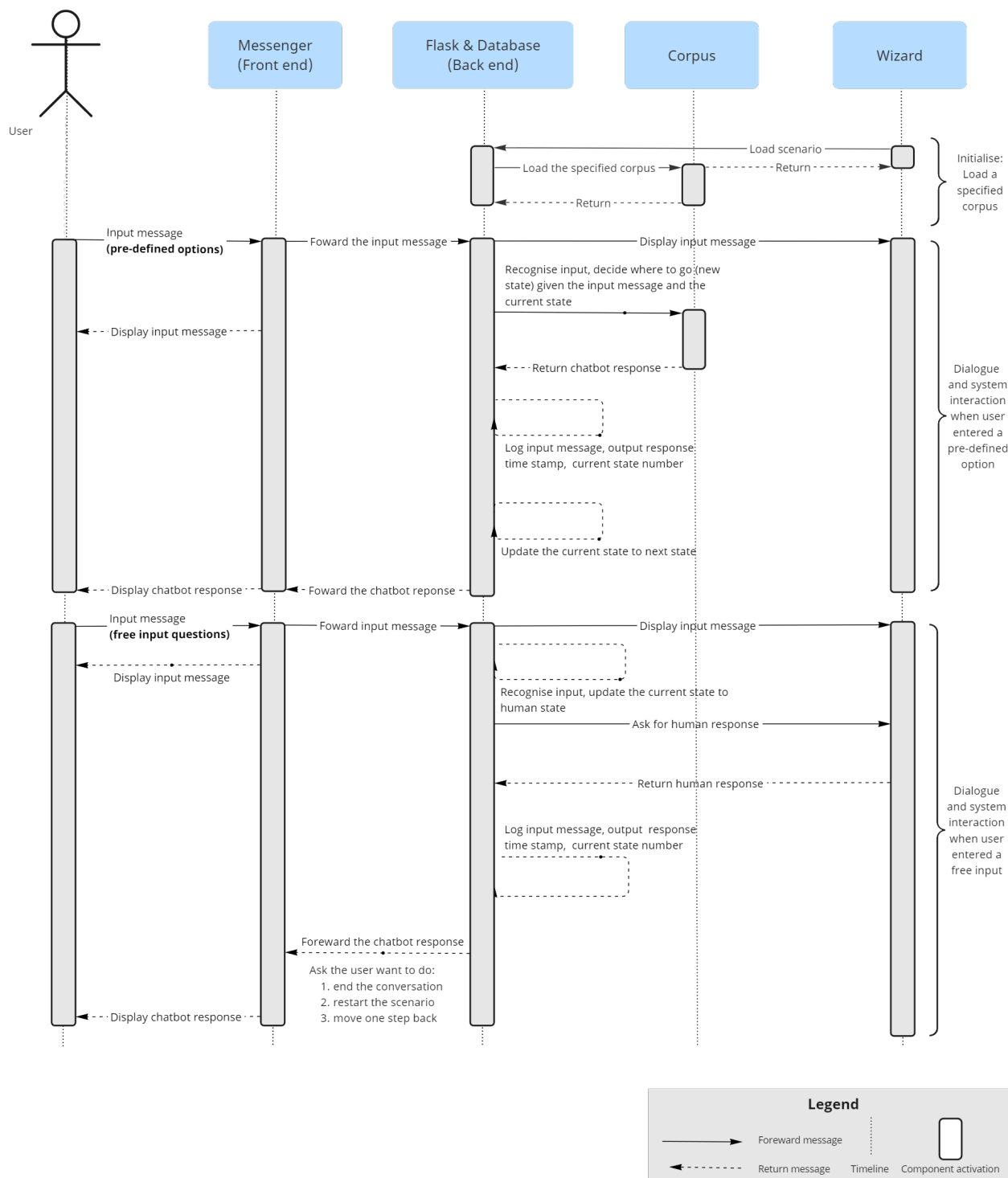


Figure 7.8 Interaction diagram between the user and the chatbot components. There are 3 types of interactional behaviours: initialising the chatbot, processing pre-defined inputs and processing free input questions. All interactions take place between the front end (i.e., Messenger) and components in the back end, the dialogue manager (i.e., Flask in the Figure), the database, the corpus and the human wizard. These components exhibit different behaviours according to the user's and wizard's inputs.

### 7.4.2.2 Dialogue flow management

Figure 7.9 uses the UML state machine diagram (*IBM Documentation, 2021*) to show the conversation management behaviour of the chatbot. Figure 7.9 illustrates our modelling of the FSM for controlling the dialogue flow. There are 4 types of states in the FSM: the greeting state, the conversation state, the summary state and the human-intervention state. The FSM decides which state to go to next according to the user's input message, the current state where the conversation is, and the transition rules between states.

After the wizard specifies the corpus in the back end, the chatbot initialises and waits for the user to start the conversation. The dialogue manager activates and enters the greeting state once the user inputs their first message, such as "Hi" or "Hello". In the greeting state, the chatbot introduces itself and specifies a list of pre-determined topics that are relevant to the use case scenario (see Figure 7.2, turn 1). The user would be allowed to choose one from the list to explore further. This type of conversational behaviour is illustrated in the Greeting state in Figure 7.9.

Once the user enters their choices, the front end passes the user's input to the dialogue manager. Then, the dialogue manager determines the chatbot's response by looking up the current state of the conversation and its associated transition rules and comparing them to the user input message. If the user's input matches a transition rule, the dialogue manager will update the current state to the new state according to the rule. Then, the dialogue manager will send the corresponding chatbot content to the front end (i.e., the navigation message, the main content, and the list of pre-defined options, see Figure 7.2, turn 2) to continue the conversation. Otherwise, the dialogue manager failed to recognise the user's input. When this happens, the dialogue manager will remain in the current state and prompt the user to re-enter a valid choice. The FSM enters this type of state repetitively as the conversation continues. However, the FSM will reach a "leaf state", where there are no more follow-up topics for the user to explore. In this case, the dialogue manager will send an extra message to the user, indicating that this is the end of the conversation and asking if the user wants to see the summary of the use case scenario. The user can either continue the conversation by choosing to "move one step back" to explore other follow-up topics, or they can end the conversation by choosing to "show the summary of the scenario" (see Figure 7.3, turn 0). This type of conversational behaviour is illustrated in the Conversation state in Figure 7.9.

If the user chooses to show the summary, the FSM will move to the Summary state. The dialogue manager will send the summary response to the user (see Figure 7.3 turn 1). At this stage, the user can choose from 4 options (see Figure 7.3, turn 1): 1. End the conversation by typing "goodbye". Then, the dialogue manager will terminate the

conversation 2. Restart the conversation from the start. The FSM will move to the Greeting state to let the chatbot introduce itself again; 3. Move one step back. The FSM will move to the leaf state that the user has entered before the summary state; 4. Ask an open question about the use case scenario. The FSM will move to the human intervention state. This type of conversational behaviour is illustrated in the Summary state in Figure 7.9.

If the user inputs free text at this stage, the dialogue manager will forward it to the human wizard to respond and then send the wizard's response to the user. At the end stage, the user can either restart the conversation or end the conversation (see Figure 7.3, turn 2). This type of conversational behaviour is illustrated in the Human-intervention state in Figure 7.9.

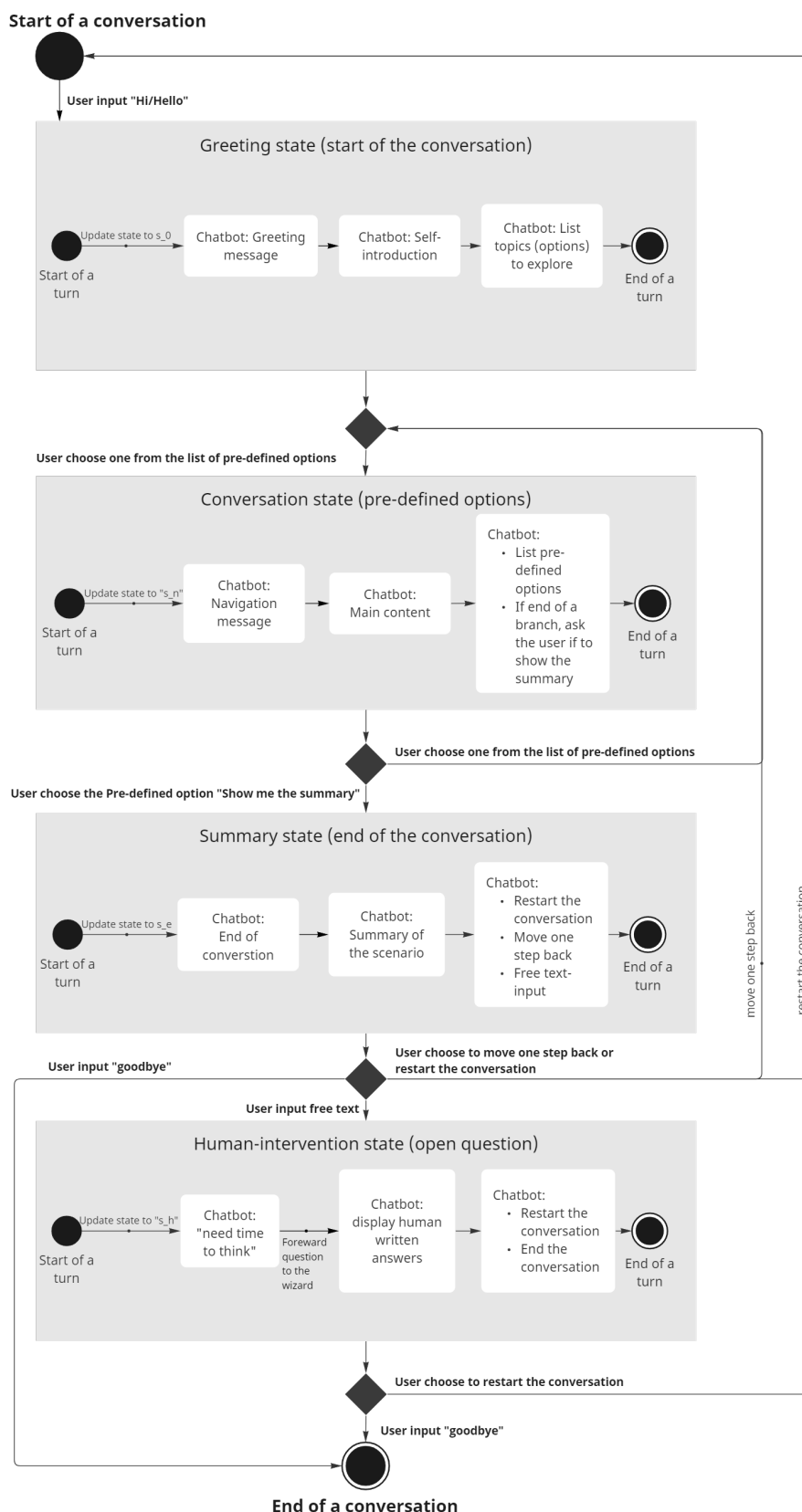


Figure 7.9 State Machine diagram. The chatbot dialogue manager exhibits 4 types of conversational behaviour, greeting, pre-defined conversation, summary and open question answering. These behavioural changes are determined by the user input, where the current state is, and transition rules associated with that state.

### 7.4.3 Dialogue Content

The implemented chatbot has 4 use case scenarios that assist users in understanding the healthcare services in the UK. Each use case scenario focused on one aspect of the UK healthcare service. Scenario 1: Overview of the UK healthcare services, introduces different services in the UK and how they are organised. Scenario 2: Self-intervention and medications, explains UK medications, pharmacies and how they can be used to manage health. Scenario 3: Managing urgent conditions and emergencies provides details about using urgent and emergency care services in the UK. Scenario 4: Managing minor and chronic conditions offers guidance on handling non-urgent illnesses, particularly emphasising the role of the GP in addressing these problems. The 4 scenarios are formulated based on students' Pain Points and ways to help in Table 7.5. The dialogue content in each use case scenario is crafted to address a specific subset of students' wants. Each use case scenario contains 3 broad topics with several follow-up topics. The user can choose what to explore freely depending on their interest.

Scenario 1 introduces healthcare services in the UK. The 3 topics in Scenario 1 are illustrated in Figure 7.10. Topic 1 provides an overview of various healthcare services available in the UK. The purpose is to let the user know about NHS, how it is being organised, and be aware of the differences in healthcare systems between China and the UK. This topic is designed to address Pain Point 7 in Table 7.5, emphasising that the healthcare system in the UK is residence-based and referral-structured compared to the insurance-based, hospital-structured system in China. Topic 2 introduces healthcare services available in the UK. It shows how different services in the UK are available to help. This addresses Students' Pain Points 1, 3, and 6 in Table 7.5, i.e., an overview of UK services work by categorising services into primary, specialised, and private services and showing the user what they do and how much they cost. Topic 3 complements Topic 2, with a particular focus on the registration of the GP. This is because visiting the GP is the most generic way to resolve health issues. This further addresses Students Want 1 on what the GP do and how to register with a GP. After exploring this use case scenario, the user is expected to gain a preliminary understanding of different healthcare services in the UK and what they do.

Scenario 2 explains medications in the UK, the role of pharmacy, and how they can be used to manage health problems. The 3 topics in Scenario 2 are illustrated in Figure 7.11. Topic 1 outlines the recommended actions to be taken by individuals to manage minor illnesses. The aim is to help the user familiarise UK pharmacies and the process of buying medicines. This topic addresses pain point 7 by highlighting the differences in pharmacies between the UK and China. Topic 2 explains UK medications and ways to access them in detail. It highlights the differences between Western and Traditional Chinese medications and describes the steps involved in obtaining the medication that

the user might need (including prescribed medications). The topic caters to Pain Points 2 and 4 in Table 7.5. Topic 3 focuses on resolving language and communication issues in the context of pharmacy visits. This topic addresses Pain Point 9 in Table 7.5. It offers suggestions for becoming familiar with the terminologies of UK medications and tips for preparing what to say during pharmacy visits. Upon interacting with this use case scenario, the user is expected to become familiarise with the steps to look up UK medications and ways to obtain them.

Scenario 3 explains the function of urgent care and emergency services in the UK. The 3 topics in Scenario 3 are illustrated in Figure 7.12. Topic 1 differentiates the urgent care service and emergency service in the UK and explains their purposes and functions respectively. This highlights the differences in emergency care between China and the UK, addressing Pain Point 7 in Table 7.5 in the context of emergency care. Topic 2 illustrates the steps to reach urgent care and emergency services and their treatment routine. It also points out the differences in emergency medical practice between China and the UK. This topic addresses pain points 5 and 7 for managing urgent conditions. Topic 3 focuses on language and communication issues under urgent conditions. It covers tips for articulating problems when contacting emergency services and during treatments. It also provides suggestions for precautionary measures in overcoming language difficulties. The user should be able to know what to do and what to expect in urgent conditions and emergencies after interacting with this use case scenario.

Scenario 4 elaborates on the role of GP in handling minor and chronic problems. The 3 topics in Scenario 4 are illustrated in Figure 7.13. Topic 1 is designed to help the user make sense of the GP, what it is for and when to use it. It also introduces the role of private GPs and how they can help. The scenario addresses Pain Point 7 in Table 7.5, where primary care doctors are not common in the Chinese healthcare system. Topic 2 describes the routine treatment process in the GP. This includes appointment booking, doctor consultations, and common treatment outcomes. It aims to introduce the treatment process for managing minor and chronic illnesses, which addresses Pain Point 5 in Table 7.5. Topic 3 guides the user to prepare for the GP consultation. It prompts the user to think about problems and needs before seeing the doctor. The topic also includes advice for resolving doctor-patient disagreements. Topic 3 on addressing language and communication problems in the context of GP visits. It aims to fulfil Pain Points 9 and 10 in Table 7.5. After completing this use case scenario, the user may be able to utilise GP efficiently to manage minor or chronic problems.

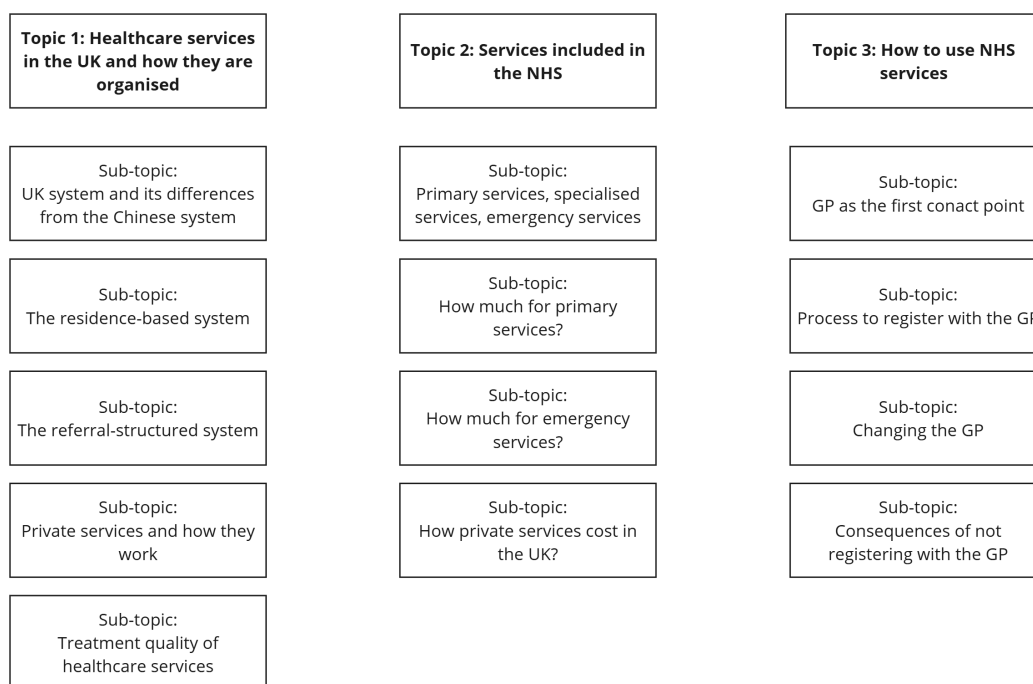


Figure 7.10 Topics and follow-up topics included in the Use Case Scenario 1. It introduces the UK healthcare system and illustrates how it works.

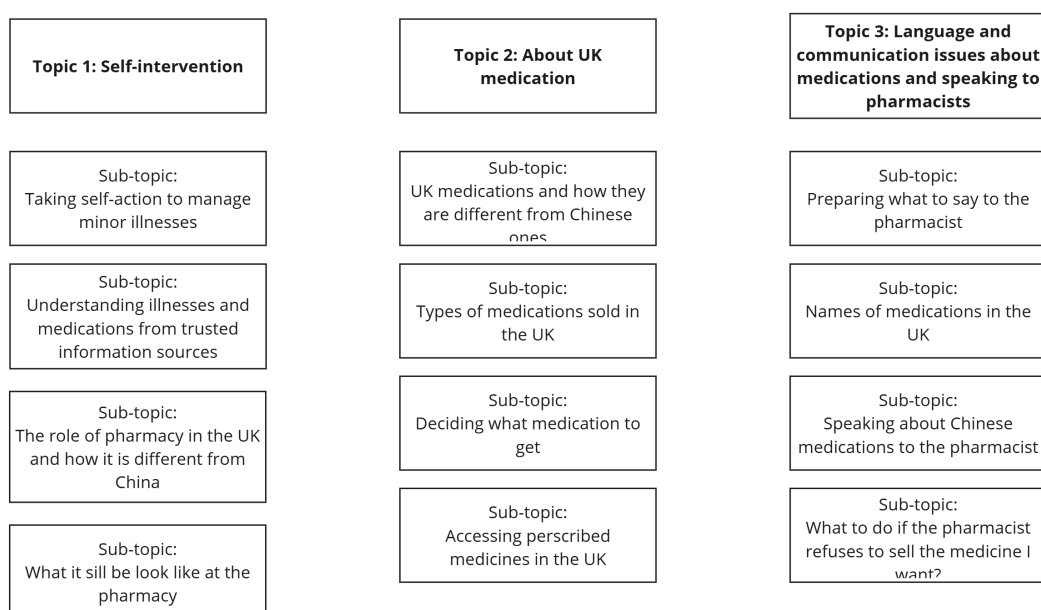


Figure 7.11 Topics and follow-up topics included in the Use Case Scenario 2. It explains to the user about UK medications and how they can be obtained.



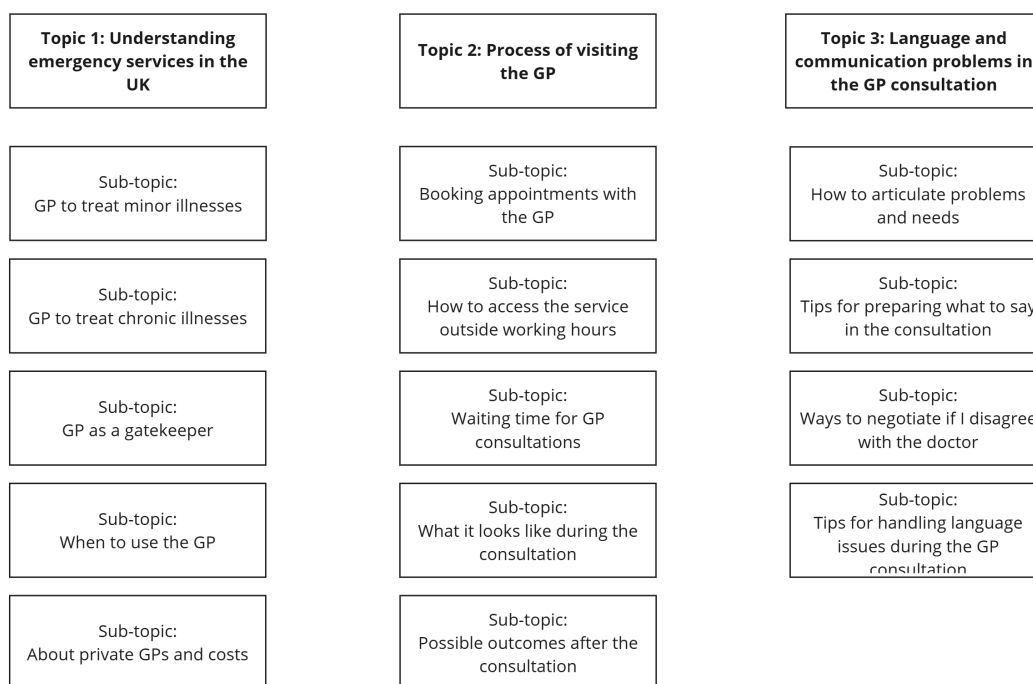


Figure 7.12 Topics and follow-up topics included in the Use Case Scenario 3. It explains to the user about services available in urgent conditions or emergencies and how they work.

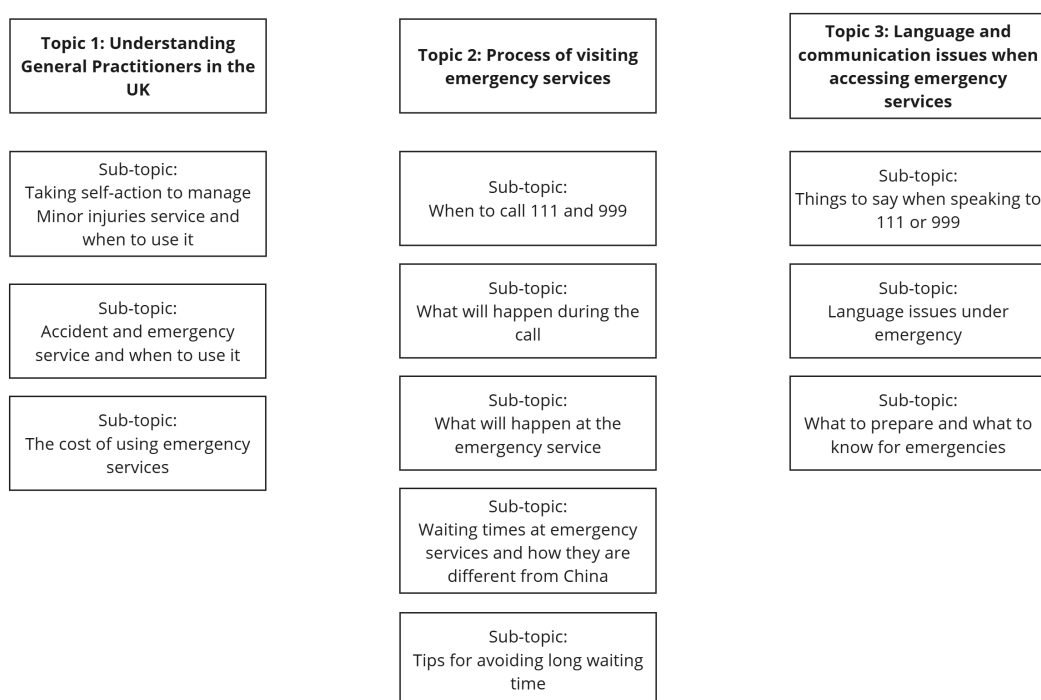


Figure 7.13 Topics and follow-up topics included in the Use Case Scenario 4. It shows how the GP can be used to help with managing minor and chronic illnesses.

## 7.5 Discussion

### 7.5.1 Limitation of the Chatbot Prototype

In this chapter, I implemented a chatbot prototype as an educational tool which aims to help Chinese students familiarise UK healthcare services and prepare for consultations. Despite its potential usefulness, the chatbot possesses some limitations, particularly in 3 aspects: limitations caused by design trade-offs, limitations caused by time constraints, and limitations caused by the purpose of the design.

The first is about trade-offs in the chatbot implementation. Our chatbot implementation prioritises simplicity over its intelligence. While the use of FSM for controlling dialogue flows keeps the implementation simple and transparent, the FSM is only suitable for managing structured conversations. Apart from the open question towards the end, the entire conversation is led by the chatbot, restricting the user to choose from pre-defined options. This sets a hard boundary on what the user can learn from the conversation. The user may only interact with the chatbot once, as subsequent interactions do not provide novel insights. Also, in chatbot-guided interactions, users may be less likely to engage with learning materials compared to active question-asking. Studies have shown that passive learning may not be the best way to retain and internalise knowledge in the healthcare context (Carter et al., 2006; Lake, 2001).

The second limitation relates to the resource and time constraints of the chatbot development. Resource-wise, not all Students wants are addressed. I do not have enough data and computation resources to train a large language model to freely answer users' enquiries (design possibility 1 in Table 7.4). Due to the unavailability gatekeeper for access to the NHS and GPs' internal systems, I cannot help Chinese students resolve problems that are associated with the NHS and GP internally (e.g., registering and booking appointments). Time-wise, the dialogue contents primarily consist of introductory materials for helping Chinese students who have just arrived in the UK. This simplifies the amount of dialogue content that needs to be written. For testing, I only invited 6 people for sense checks and usability tests. The purpose of these tests is to develop a minimum viable chatbot that can be used in the Wizard of Oz experiment; therefore, these tests are rather unsystematic and informal. I did not use any unit tests and standardised questionnaires, but verbal feedback to spot potential bugs and usability issues.

Finally, the purpose of the design limits the way the chatbot can be used. Since the chatbot is designed as an instrument for a Wizard of Oz experiment, our implementation only works when a wizard is available behind the scenes. It cannot be directly deployed in real-world settings. In addition, although dialogue materials are

written based on trustworthy sources, they are not fully validated by domain experts. The purpose of the chatbot is only to evaluate the potential of chatbots in helping Chinese students with healthcare service utilisation. Potential inaccuracies may cause the user to misinterpret the content if no one monitors the interaction.

### 7.5.2 Conclusion

In this chapter, I described the design and implementation of an educational chatbot to help Chinese students make sense of the UK healthcare system and prepare for consultations. I used findings from Chapters 4, 5 and 6 to guide the design of the chatbot. By the end of this chapter, I developed a rule-based, FSM-controlled, human-scripted chatbot, which was targeted to promote healthcare service visits for Chinese students who had just arrived in the UK. The developed chatbot will be used as an instrument for a Wizard of Oz experiment to evaluate the potential of chatbots in supporting Chinese students. This chapter, together with Chapter 8, answers RQ3, “How has the dialogue system (the chatbot prototype) we created impacted Chinese overseas students’ willingness to use healthcare services in the UK?”.

Design-wise, I created 3 Personas to contextualise and categorise students’ pain points and needs that were identified in Chapter 6. I examined students’ pain points and design requirements in detail to shape the functions of the chatbot (see Table 7.4). Given the resource constraints, I chose to build the chatbot in the form of an educational tool because it covers the majority of the Students’ pain points. The chatbot specifications are derived from Students’ pain points and are shown in Table 7.5. According to students’ pain points, an educational chatbot can help Chinese students in 4 ways: by giving overviews about the roles of different UK services, explaining the use of medications in the UK, introducing treatment processes of different services, and assisting in overcoming language and communication issues in healthcare contexts. I designed 4 use case scenarios to meet these specifications: Overview of UK healthcare services, self-management and medications, handling urgent conditions and emergencies, and handling minor and chronic conditions.

Implementation-wise, I used an agile approach to develop the chatbot. I used Facebook Messenger (*Messenger Developer Tools*, 2023) and Flask (*Flask*, 2023) framework to implement the chatbot as a web application. The chatbot handles structured conversations with pre-defined user inputs using an FSM. It can also answer open questions with the help of a human wizard behind the scenes at the end stage of the conversation. The dialogue content is adapted from trustworthy sources (*Healthtalk*, 2023; *NHS England*, 2023a; *NHS Scotland*, 2023). The implemented chatbot was then tested by 6 people in 3 cycles for sense checks and usability improvements.

By the end of the development process, I built a rule-based, FSM-controlled, human-scripted chatbot which aims to help Chinese students who have just arrived in the UK to understand the healthcare system and prepare for consultations. The implemented chatbot is purposed for a Wizard of Oz experiment with no aim of deploying it in real-world settings. In the next chapter, I will evaluate its effectiveness in positively changing Chinese overseas students' willingness to utilise UK healthcare service. The key contribution of this chapter is listed below.

1. Implemented a chatbot prototype as an experimental instrument, which is ready to be evaluated to further explore the design space of chatbots in supporting Chinese students' healthcare service visits.
2. Summarised students' pain points and needs of how a chatbot can help. Discussed possible design options for building the chatbot and outlined the specifications for supporting Chinese students to understand the healthcare system and prepare for consultations.
3. Documented the development process of the chatbot.

## Chapter 8: Chatbot Prototype Evaluation

### 8.1 Introduction and Motivation

This chapter describes a Wizard of Oz (WoZ) experiment which investigates the potential of chatbots in supporting Chinese students' healthcare service utilisation in the UK. This chapter uses a quantitative approach to answer RQ3, "How has the dialogue system (the chatbot prototype) we created impacted Chinese overseas students' willingness to use healthcare services in the UK?".

In the Wizard of Oz experiment, we examined the impact of the educational chatbot prototype, which was implemented in Chapter 7, on its effectiveness in encouraging healthcare service utilisation among Chinese students who recently arrived in the UK. Results from Chapter 5 suggested that students perceived difficulties regarding healthcare service utilisation, and students' attitudes towards healthcare services may influence students' willingness to use healthcare services. As indicated by the result in Chapter 5, we formulated the following hypotheses to examine the effect of the educational chatbot on Chinese students' willingness to visit UK healthcare services:

**[H1]:** A chatbot conversation interaction can raise the user's intention to use healthcare services in the UK.

**[H2]:** A chatbot conversation interaction can reduce the user's perceived difficulties in visiting UK healthcare services.

**[H3]:** A chatbot conversation interaction can change the user's attitude towards UK healthcare services to be more positive.

H1 examines the influence of the educational chatbot on Chinese students' overall intention to utilise healthcare services in the UK. H2 is formulated to investigate the effect of the educational chatbot on Chinese students' perception of difficulties in using UK healthcare services. H3 looks at the impact of the educational chatbot on Chinese students' subjective attitudes towards healthcare services in the UK.

This chapter is structured by the following: First, we present the Wizard of Oz (WoZ) experiment, with explanations of the experiment procedures and questionnaire designs. Then, we illustrate the WoZ experiment setup, data collection and analysis procedure. Next, we present the experiment results for each hypothesis. Finally, we discuss the impact of the chatbot conversation on Chinese students' willingness for healthcare service utilisation. This chapter uses a mixed-method approach to evaluate a chatbot that is designed for the user to familiarise themselves with UK healthcare

services. We used the WoZ technique to explore the potential use of chatbots in assisting Chinese overseas students with their healthcare service visits. The experiment evaluates how the educational chatbot influences Chinese students' willingness to use healthcare services in the UK.

## 8.2 Method

### 8.2.1 Experiment overview

Chapter 3, Section 3.3.3, introduced the concept of WoZ. Specific to this WoZ experiment, we used a mixed-method design with pre- and post-experiment questionnaires and usability questionnaires, followed by a post-experiment interview. The pre- and post-questionnaires (Section 8.2.2) examine the effects of the chatbot system on Chinese students' (who recently arrived in the UK) intentions for healthcare service visits. The quantitative results derived from the questionnaires evaluate hypotheses H1, H2, and H3. The hypotheses, in turn, answer RQ3. The usability questionnaire, SASSI (Section 8.2.3), measures users' satisfaction with the chatbot system using scales. The semi-structured interview (Section 8.2.4) elicits participants' subjective feelings and opinions about the chatbot system. This qualitative data is triangulated with the pre- and post-questionnaires to elucidate quantitative results.

As shown in Figure 8.1, the experiment consists of the following activities: 1. Introducing participants to the experiment, 2. Choosing the use case scenarios, 3. Filling healthcare services visits questionnaires (see Section 8.2.2), 3. WoZ chatbot interaction, 4. Filling chatbot experience questionnaire (SASSI, see Section 8.2.3), 5. Post-experiment interview. Activities 2, 3, 4, and 5 of the experiment are shown in Figure 8.2.

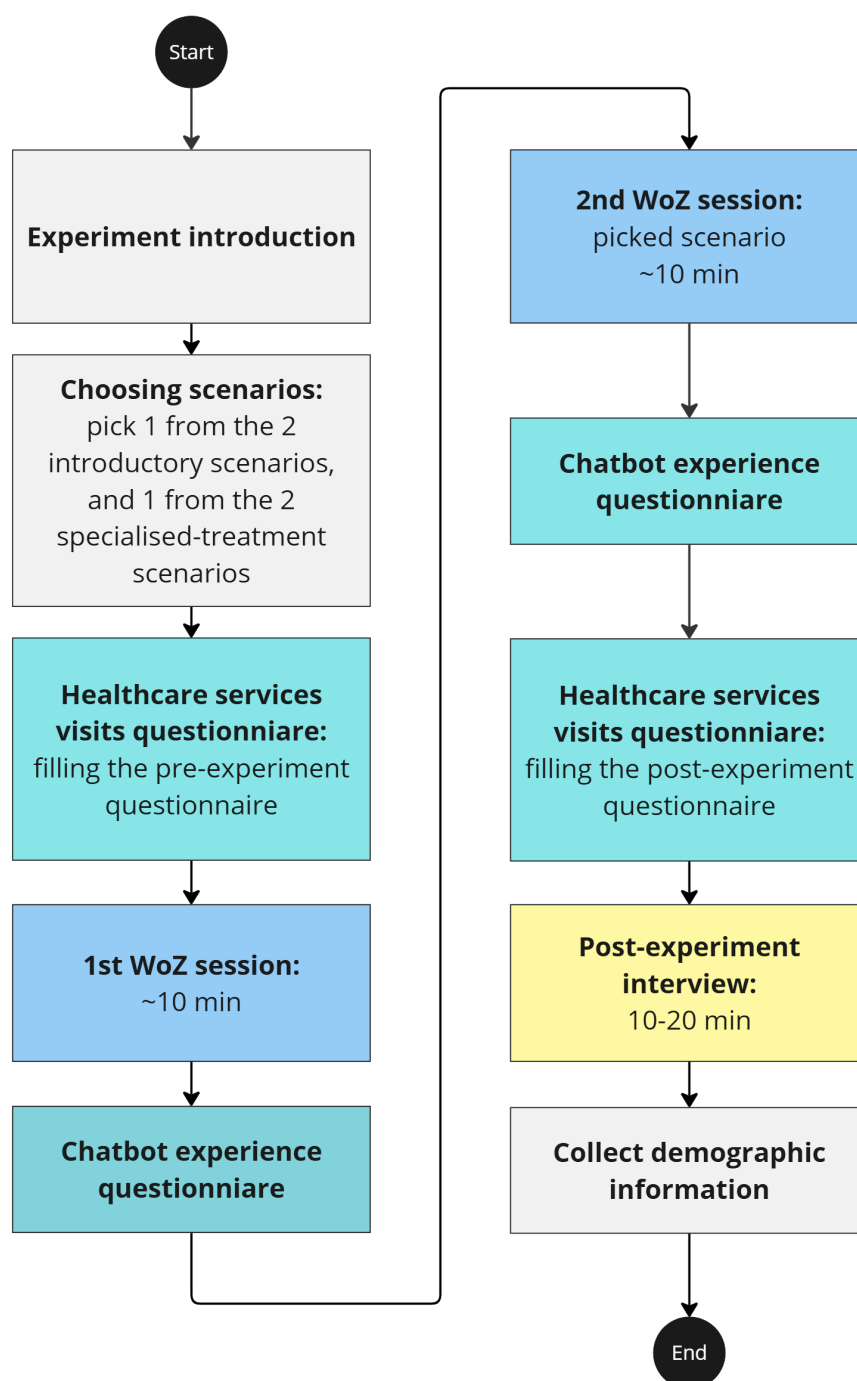


Figure 8.1 The WoZ experiment procedure. The experiment consists of 2 sessions of WoZ interactions (blue). The participant is asked to choose 2 out of the 4 use case scenarios: one from the introductory scenarios, an overview of the UK healthcare system or medication and self-management, and one out of the specialised scenarios: managing urgent conditions or managing minor and chronic illnesses (see Section 7.2.2 for details of the 4 use case scenarios). Participants are asked to fill out the healthcare services visits questionnaire before and after completing all sessions (light cyan). They are also asked to fill out the SASSI questionnaire before and after each WoZ session (dark cyan).

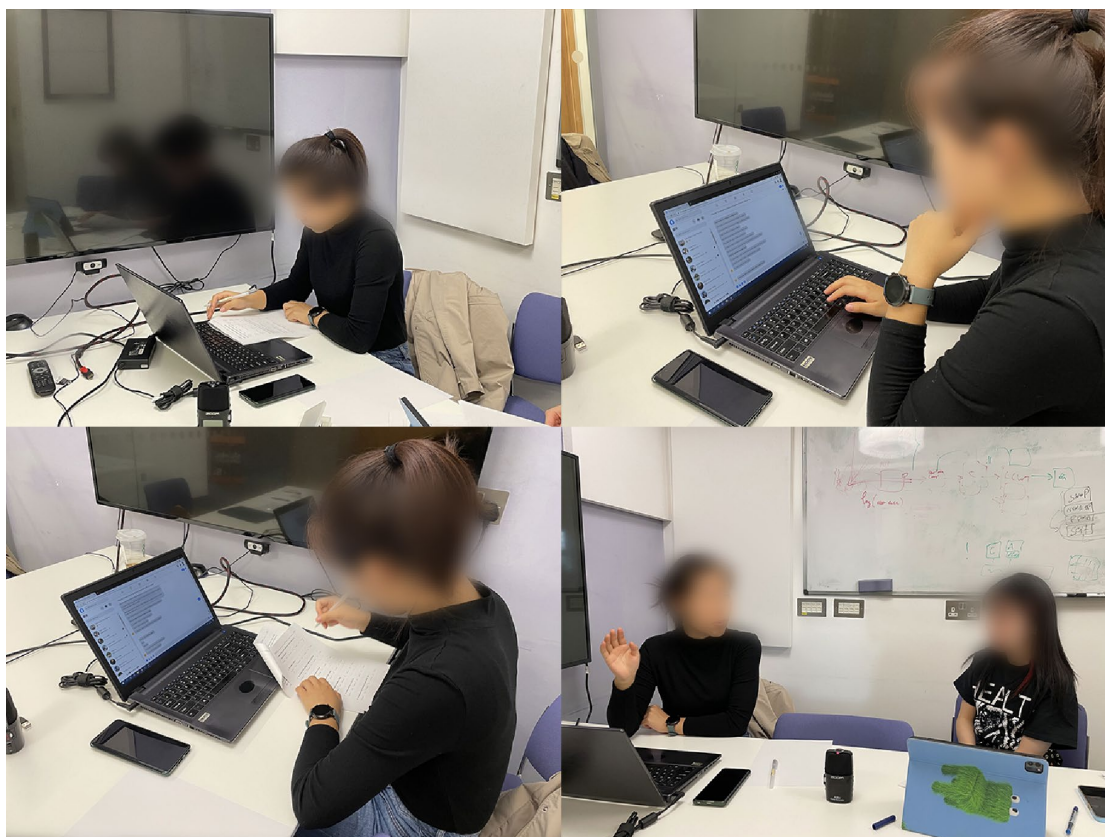


Figure 8.2 The WoZ experiment. Top left: the participant was filling out the pre-experiment (healthcare service visits) questionnaire. Top right: the participant was interacting with the chatbot system. Bottom left: the participant was filling out the chatbot experience (SASSI) questionnaire. Bottom right: the participant was being interviewed. Photos were taken with consent.

At the start of the experiment, the experiment facilitator introduces the participant to the purpose and steps involved in the experiment. The facilitator explains the process of data collection and answers participants' concerns. If the participant decides to proceed with the experiment, the facilitator will guide the participant to familiarise the chatbot system and how to chat with it. At this stage, the facilitator keeps the "human wizard" hidden from the participant. The participant is told to evaluate a real chatbot that is designed to support healthcare service visits in the UK.

Next, the participant is asked to select 2 of the 4 use case scenarios to explore. The 4 use case scenarios are 1. Overview of the healthcare services in the UK, 2. Self-management and medications, 3. Managing urgent conditions and emergencies, 4. GPs and managing minor and chronic issues (see Section 7.2.2). The first 2 scenarios are introductory scenarios, which briefly present different services in the UK healthcare system. The latter 2 scenarios are specialised scenarios, which explain the role, the treatment process and potential problems involved when using a particular UK healthcare service. The participant is asked to choose 1 from the first 2 scenarios



and 1 from the last 2 scenarios. This ensures the participant to be exposed to various topics with different degrees of detail while also honouring their personal interests.

Before the interaction, the participant is asked to fill out a questionnaire regarding their healthcare service utilisation behaviour before interacting with the chatbot system (Figure 8.2, top left). This questionnaire examines Chinese students' healthcare service visiting behaviour based on the Theory of Planned Behaviour of healthcare service utilisation that we developed in Chapter 5. Details of this questionnaire are described in Section 8.2.2.

The participant interacts with the chatbot system and explores the use case scenario that they have chosen first (Figure 8.2, top right). There are no time and dialogue-turn constraints. Participants can interact with the chatbot for as many turns as they like, but may only ask open-ended questions at the end of each use case scenario. Once they would like to end the conversation, they are asked to fill out another questionnaire which examines the participant's subjective experiences in using the chatbot (Figure 8.2, bottom left, see Section 8.2.3 for details of the questionnaire). These 2 steps repeat in sequence when the participant interacts with the chatbot for the second use case scenario that they have chosen.

After the interaction, the participant is required to fill out the same questionnaire regarding the healthcare service visits to examine any changes. They are also invited to a post-experiment semi-structured interview to further elucidate their opinions and feelings towards the UK healthcare system and the chatbot. The facilitator concludes the experiment by disclosing the fact of the "human wizard" and collects the demographic information of the participant at the end of the interview. In the experiment, the chatbot dialogue and the 2 questionnaires are written in English, supplemented by Chinese keywords. The experiment introduction and the post-experiment interview are conducted in Mandarin to facilitate communication.

### **8.2.2 The healthcare service visits questionnaire**

The healthcare service visits questionnaire is used before and after the WoZ experiment to examine changes in participants' intention of healthcare service visits. This questionnaire aims to answer RQ3. It is designed to measure "the willingness of Chinese students to use healthcare services in the UK".

From Chapter 5, we know that Chinese overseas students' healthcare service visiting behaviour can be described using the theory of planned behaviour. Students' willingness (i.e., intention) to visit healthcare services is influenced by 4 determinants: the direct motivation to use, the attitude towards UK healthcare services, the perceived difficulties of using services, and the influence of the social environment. To

fully capture the effect of the chatbot on students' willingness, we constructed the healthcare service visits questionnaire following the standard procedure of setting up the theory of planned behaviour questionnaire (Ajzen, 2002a, 2006). This procedure is used in many healthcare behavioural studies to investigate specific behaviours and changes in those behaviours where standardised questionnaires are not suitable (Ajzen & Driver, 1992; Cha et al., 2007; González et al., 2012).

The construction of the healthcare service visits questionnaire is iterative. The first iteration of the questionnaire was constructed and discussed by a group of researchers to determine question items. The second iteration of the questionnaire was built and discussed by the same group of researchers for a sense check and formatting. The third iteration of the questionnaire was tested in pilot experiments with 2 native English speakers and 2 Chinese students. Minor adjustments, such as wording, formatting and explanation of concepts, were made to improve the clarity. Although we followed Ajzen's (2006) instructions to construct the questionnaire, we did not fully validate the questionnaire due to time and resource constraints. Validating such a questionnaire requires massive recruitment of participants. This deviates from our research aim, where we want to investigate the effect of the chatbot on Chinese overseas students' intention to utilise healthcare services.

The constructed healthcare service visits questionnaire consists of 5 sections with 43 items. The full questionnaire is shown in Table 8.1. The first section investigates the nominal intention of healthcare service utilisation and its link to the severity of the illness. The second section examines the participants' general attitude towards the NHS. The third section looks at the social influence of other people on participants' perceptions of healthcare service visits. The fourth section studies perceived difficulties and actual burdens of visiting healthcare services. The last section scrutinises the participants' attitudes toward specific matters of the UK healthcare system. The four determinants of healthcare service utilisation: intention, attitudes, perceived difficulties and direct motivations are all covered in this questionnaire. The full coverage of determinants helps to triangulate with the grounded theory results.

Table 8.1 Items and their associated themes of the healthcare service visits behaviour questionnaire. Themes are linked to the grounded theory categories (see Section 5.4.1), which describe Chinese behaviour of healthcare services in the UK. The table also shows the questionnaire items that we chose for hypothesis testing.

| Question                                                                                                                                         | Associating theme                          | Hypotheses testing |
|--------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|--------------------|
| 1.1 I intend to use UK healthcare services for help:<br>1.1.1 If I feel slightly ill<br>1.1.2 If I feel somewhat ill<br>1.2.3 If I feel very ill | Intention for UK healthcare service visits | H1                 |

|                                                                                                                                                                                                                 |                                                                        |              |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|--------------|
| 1.2 When I feel ill in the UK, my first reaction is to use relevant UK healthcare services                                                                                                                      | Alternative solutions for accessing UK healthcare services             | Not included |
| 1.3 When I feel ill in the UK, my first reaction is to solve the problem myself with remedies that I already know                                                                                               |                                                                        | Not included |
| How do you feel about healthcare services in the UK?<br>From very useless to very helpful<br>From very bad to very good<br>From difficult-to-use to easy-to-use                                                 | The overall attitude towards the UK healthcare system                  | H3           |
| 3.1 People who live in the UK would expect me to use UK healthcare services for help:<br>3.1.1 If I feel slightly ill<br>3.1.2 If I feel somewhat ill<br>3.1.3 If I feel very ill                               | Social influence: other people's views on healthcare service visits    | Not included |
| 3.2 Other Chinese overseas students would expect me to use UK healthcare services for help:<br>3.2.1 If I feel slightly ill<br>3.2.2 If I feel somewhat ill<br>3.2.3 If I feel very ill                         |                                                                        | Not included |
| 3.3 Friends and family in China would expect me to use UK healthcare services for help:<br>3.3.1 If I feel slightly ill<br>3.3.2 If I feel somewhat ill<br>3.3.3 If I feel very ill                             |                                                                        | Not included |
| 3.4 Based on your experience, people who live in the UK would use UK healthcare services for help:<br>3.4.1 If they feel slightly ill<br>3.4.2 If they feel somewhat ill<br>3.4.3 If they feel very ill         | Social influence: other people behave during healthcare service visits | Not included |
| 3.5 Based on your experience, overseas students, who are not Chinese, use UK healthcare services for help:<br>3.5.1 If they feel slightly ill<br>3.5.2 If they feel somewhat ill<br>3.5.3 If they feel very ill |                                                                        | Not included |
| 3.6 Based on your experience, Chinese overseas students would use UK healthcare services for help:<br>3.6.1 If they feel slightly ill<br>3.6.2 If they feel somewhat ill<br>3.6.3 If they feel very ill         |                                                                        | Not included |
| 3.7 Based on your experience, friends and family in China use healthcare services for help:<br>3.7.1 If they feel slightly ill<br>3.7.2 If they feel somewhat ill<br>3.7.3 If they feel very ill                |                                                                        | Not included |
|                                                                                                                                                                                                                 |                                                                        |              |

|                                                                                                                                                                                                                                                                                                                                               |                                                   |              |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|--------------|
| 4.1 If I use relevant UK healthcare services when I am ill:<br>4.1.1 I am confident that I can communicate my needs<br>4.1.2 I can identify the services that will give me the right care<br>4.1.3 I am familiar with the care process. I know what to do next to solve the problem<br>4.1.4 I know where to look up things that I don't know | Self-efficacy and perceived difficulties          | H2           |
| 4.2 When deciding whether or not to use UK healthcare services:<br>4.2.1 I decide only based on the state of my health<br>4.2.2 I have to worry about non-health-related things                                                                                                                                                               | Confounding factors for healthcare service visits | Not included |
| 5.1 Using the UK healthcare system will resolve my health problems                                                                                                                                                                                                                                                                            | Specific attitudes towards UK healthcare services | Not included |
| 5.2 Thinking of using the UK healthcare system is stressful                                                                                                                                                                                                                                                                                   |                                                   | Not included |
| 5.3 Using the UK healthcare system will require a lot of time and effort from me                                                                                                                                                                                                                                                              |                                                   | Not included |
| 5.4 When using UK healthcare services, it is the doctor's responsibility to look after me                                                                                                                                                                                                                                                     |                                                   | Not included |
| 5.5 When using UK healthcare services, the doctor will take me seriously                                                                                                                                                                                                                                                                      |                                                   | Not included |
| 5.6 When using UK healthcare services, I will never openly disagree with doctors' advice                                                                                                                                                                                                                                                      |                                                   | Not included |
| 5.7 When using UK healthcare services, I know how they work and what I can expect from them                                                                                                                                                                                                                                                   |                                                   | Not included |
| 5.8 When thinking of using UK healthcare services, I know how to use Western Medicine concepts to discuss my problems instead of Chinese Traditional Medicine concepts                                                                                                                                                                        |                                                   | Not included |

To answer RQ3, we chose 10 questionnaire items from the questionnaire for testing hypotheses H1, H2 and H3 (see Table 8.1). Item 1.1 and its subsequent questions measure the intention of a healthcare service visit directly. It corresponds to the intention for healthcare service utilisation in the grounded theory. It examines H1, the effect of chatbot conversations on users' intention to use healthcare services in the UK. Items 1.2 and 1.3 also investigate the intention of healthcare service visits; however, their statements are less direct, such as measuring first reactions and alternative activities. Therefore, we discard Item 1.2 and Item 1.3 to avoid repetition and ambiguity. Item 2 and its subsequent questions evaluate the students' overall attitude towards NHS. It corresponds to the attitude towards UK healthcare service in the grounded theory. It examines H3, about students' attitudes and changes in attitudes towards UK healthcare services. Items in section 5 (5.X) also correspond to H3;

however, these items focus on attitudes toward specific aspects of the UK healthcare system. They may not be as representative as the items in section 2 (2.X), which examines the overall attitude. Item 4.1 and its subsequent questions look at the perceived difficulties in visiting healthcare services. It corresponds to the perceived difficulties in the grounded theory. Items in this section examine H2 concerning the confidence of actions associated with visiting healthcare services. This questionnaire covers all aspects of healthcare service visits in the grounded theory study, and we chose 10 items from the questionnaire to examine the effect of the chatbot on changes in intention (H1), overall attitude (H3), and perceived difficulties (H2).

### 8.2.3 The SASSI questionnaire

We used the Subjective Assessment of Speech System Interfaces (SASSI) questionnaire to measure participants' experience with the chatbot. SASSI is a standardised questionnaire developed by Hone and Graham (2000) to evaluate subjective satisfaction or users' "perceived usability" with speech system interfaces (Larsen, 2003). The SASSI questionnaire focuses on the conversational aspect of the dialogue system. Although it was developed for spoken dialogue systems, it is also being used widely to evaluate other forms of conversational systems (Dzikovska et al., 2011; Oruche et al., 2021; Grassi et al., 2022; Mitchell et al., 2022).

The SASSI questionnaire evaluates the conversational experience. The questionnaire consists of 34 items and is grouped into 6 dimensions: the system response accuracy, likeability, cognitive demand, annoyance, habitability and speed. The full questionnaire is illustrated in Appendix E3, and the meanings of these dimensions are described in Table 8.2.

Table 8.2 The SASSI questionnaire, its 6 dimensions, and their corresponding questionnaire items. The meanings of the 6 dimensions are adapted from Hone & Graham (2000) to fit text-based chatbot systems. The full questionnaire is illustrated in Appendix E3.

| SASSI dimensions         | Definition                                                                                   | Covered by the item |
|--------------------------|----------------------------------------------------------------------------------------------|---------------------|
| System response accuracy | To what degree and how often the chatbot interprets the user's input and responses correctly | 1 to 9              |
| Likeability              | How useful, pleasant and easy it is to interact with the chatbot                             | 10 to 18            |
| Cognitive demand         | What level of effort and concentration is needed to interact with the chatbot                | 19 to 23            |
| Annoyance                | Whether interacting with the chatbot was repetitive, boring, or irritating                   | 24 to 28            |
| Habitability             | To what extent the user knows what to do and knows what the system is doing                  | 29 to 32            |

|       |                                                      |          |
|-------|------------------------------------------------------|----------|
| Speed | How quickly the chatbot responds to the user's input | 33 to 34 |
|-------|------------------------------------------------------|----------|

The questionnaire items are constructed in the form of statements. For each item in the questionnaire, users are asked to rate each statement based on their level of agreement on a 7-point Likert scale, from strongly disagree (1) to neutral (4) and then to strongly agree (7).

The SASSI questionnaire aligns with our purpose of evaluating the chatbot system used in the WoZ experiment. This is because we want to measure the usability of the chatbot system as well as participants' subjective opinions about their interaction experience. The SASSI questionnaire incorporates usability, as well as participants' perceived effectiveness and their emotions, together to depict the chatbot interaction experience (Kocaballi et al., 2018).

#### **8.2.4 Post-experiment interview**

At the end of each WoZ experiment, we invited participants to conduct a semi-structured interview. The purpose of the interview is to elicit their feelings and opinions regarding the chatbot and the UK healthcare services. Participants were encouraged to explain their questionnaire choices, which were otherwise not reflected in the questionnaire results.

The Semi-structured interview consists of 7 topics and one additional question regarding the awareness of the WoZ setup. The interview schedule was designed to cover the following topics: opinions and feelings about the intention to visit healthcare services in the UK, attitudes towards UK healthcare services and perceptions of ease for healthcare service visits. These topics correspond to the category of intention, attitude, and perceived difficulties from categories in the grounded theory. These topics helped us to triangulate the results in the healthcare service utilisation questionnaire and gain insights into Chinese students' thoughts and behaviour. The interview also covers an additional topic about explaining the choice, use case scenarios and the chatbot's user experience. This topic helped us to investigate the usefulness of the implemented chatbot and spot future improvements.

During the interview, participants were guided by the experiment facilitator. For each topic, the facilitator asked the participant a main question and prompted the participant to elaborate further based on the interview schedule. The interview schedule contains topics and a list of main questions and possible prompts. The full interview schedule is shown in Appendix E4. The interview lasted 10 to 20 minutes.

Table 8.3 Key topic and example prompts being asked in the post-experiment interview. The interview is structured in a semi-structured format with key topics with prompts. See Appendix E4 for the full interview schedule (in both English and Chinese).

| Key topics                                                                                        | Examples of main questions and prompts                                                                                                                                                                                                                            |
|---------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Motivations for choosing scenarios                                                                | <ul style="list-style-type: none"> <li>• Which 2 use case scenarios have you picked, and why?</li> </ul>                                                                                                                                                          |
| Overall impression of the chatbot experience                                                      | <ul style="list-style-type: none"> <li>• How do you feel about the interaction with the chatbot?</li> <li>• Was there anything you particularly liked or disliked?</li> </ul>                                                                                     |
| Things learned from the chatbot                                                                   | <ul style="list-style-type: none"> <li>• Do you feel you learned anything new or interesting?</li> <li>• What do you remember from the conversation?</li> </ul>                                                                                                   |
| Elicit opinions on perceived difficulties and changes in perception after the chatbot interaction | <ul style="list-style-type: none"> <li>• After interacting with the chatbot, how confident are you when dealing with minor problems? Why?</li> </ul>                                                                                                              |
| Elicit opinions about attitudes and changes in attitudes about the UK healthcare system           | <ul style="list-style-type: none"> <li>• How do you feel about the UK healthcare system? How is the UK health system different from China?</li> <li>• To what extent has your attitude towards using the UK healthcare system changed, if at all? Why?</li> </ul> |
| Elicit opinions on the experience with the chatbot system                                         | <ul style="list-style-type: none"> <li>• To what extent did you find the conversations helpful? Or to what extent did the conversation feel confusing?</li> <li>• How can we make the chatbot better?</li> </ul>                                                  |
| Elicit opinions on intention and changes in intention to visit healthcare services in the UK      | <ul style="list-style-type: none"> <li>• When having health problems, do you prefer to overcome health problems by yourself or to seek help from the NHS? Why?</li> <li>• Any changes before and after attending the experiment?</li> </ul>                       |
| WoZ setup disclosure                                                                              | <ul style="list-style-type: none"> <li>• Can you tell that this wasn't a real chatbot? If yes, why?</li> </ul>                                                                                                                                                    |

## 8.3 Data collection and analysis

### 8.3.1 Pilot experiment

Once the chatbot system had been built and tested, we invited 2 Chinese students separately to go through the procedure that was mentioned in Section 8.2.1. Both students can speak English and Mandarin fluently. The purpose of the pilot experiment

is to test the flow and train the facilitator and the human wizard to become familiar with the experiment setup (Section 8.3.2).

From the pilot experiments, various improvements have been made. For example, students had reported that the chatbot was confusing to interact with, as the user could switch between asking pre-defined and open questions. We added navigational sentences into the chatbot system and asked the experiment facilitator to instruct the participant about chatbot operations in the formal experiment. In the pilot experiments, students were asked to choose use case scenarios before each WoZ session.

In WoZ experiments, any actions related to the wizard should not be revealed to the participant. However, during our test run, students noticed the experiment facilitator sending text messages to the “wizard,” informing the “wizard” about the use case scenarios the students had chosen (see Section 8.3.2 for details). Thus, we adjusted the experiment procedure. Participants are asked to choose use case scenarios at the start of the experiment, and the facilitator should send the message while the participant is filling out the pre-experiment questionnaire. We also developed an “excuse” for sending messages: we need to send mobile phone messages to initialise the backend of the chatbot system.

### **8.3.2 Recruitment and experiment setup**

Formal experiments were conducted in August and September 2022. This study was conducted after COVID restrictions were lifted. Similar to the grounded theory and the workshop, we recruited students from the University of Edinburgh because of the convenient availability of Chinese overseas students. The experiment focuses on Chinese overseas students who use the healthcare system in Scotland.

We used the following criteria to recruit participants: 1. Chinese students who are currently studying in one of the higher education institutes in Scotland. 2. They have to be in the UK for no more than 3 months and with only limited healthcare experience (such as registering GPs), or they have never contacted any UK healthcare services while they are in the UK. We recruit new students because they are more representative compared to students who have lived in the UK for a long time. New students share generalised problems which other students would also encounter, e.g., accessing a new service or understanding the healthcare system, whereas acculturated students would have more individual-specific needs (see Persona A vs Persona C in Section 7.2). Participants were recruited in two ways: advertising through the University’s email lists and posting via online platforms (e.g., WeChat groups,



University Microsoft Teams channels, University's career services). Participants were recruited voluntarily. No compelling words were used in recruitment posters.

Experiments were conducted in two quiet rooms. In Room A, one experiment facilitator presented alongside the participant. At the start of the experiment, the role of the facilitator is to introduce participants to the experiment and teach participants how to interact with the chatbot. The facilitator was also in charge of explaining to participants that their participation was voluntary and that they had the right to skip and withdraw. The facilitator sent the participant's choices of use case scenarios to the human wizard through a mobile phone while the participant was filling out the pre-experiment questionnaire. Before the two WoZ sessions, the facilitator interviewed participants regarding their experience and opinions about the chatbot.

The human wizard sat in room B during the entire experiment. The wizard loaded the corresponding corpora into the chatbot system after receiving the message from the facilitator. While the participant was interacting with the chatbot, the human wizard monitored the dialogue. If the participant sends an open question, the wizard then reads and answers that question by typing it into the back end of the system.

In the end, the participant was informed about the presence of the human wizard after their demographic information had been collected. The entire experiment lasted approximately 60 minutes. The participant received a £10 Amazon voucher for compensation after completing the experiment. This study was approved according to the University of Edinburgh Informatics Research Ethics Process, with RT number 2021/49786.

Table 8.4 Participants' demographic information for WoZ experiment . (\*) We aimed to recruit Chinese overseas students who arrived in the UK for no more than 3 months. However, due to the underrepresentation of undergraduate students, we included 2 undergraduate students who stayed in the UK for more than 3 months ,but with no contact and with limited understanding of healthcare services in the UK.

| ID | Gender | Area of Study          | Language skills (CEFR levels) | Length of stay in the UK |
|----|--------|------------------------|-------------------------------|--------------------------|
| P1 | Female | MA Education           | C1                            | < 1 month                |
| P2 | Male   | MRes Computer Science  | B2                            | 2 months                 |
| P3 | Female | MA Education           | B2                            | < 1 month                |
| P4 | Female | MSc Accounting         | C1                            | 1 month                  |
| P5 | Female | MA Education           | C1                            | 1 month                  |
| P6 | Female | MA Economics           | B2                            | 2 months                 |
| P7 | Female | MSc Biomedical Science | B2                            | 3 months                 |
| P8 | Female | MSc Design Informatics | C1                            | < 1 month                |

|     |        |                        |    |                                              |
|-----|--------|------------------------|----|----------------------------------------------|
| P9  | Female | BSc Architecture       | C1 | > 6 months, but no contact with UK services* |
| P10 | Female | MSc Computer Science   | C1 | < 1 month                                    |
| P11 | Female | MSc Design Informatics | C1 | 1 month                                      |
| P12 | Female | MA Psychology          | C1 | 2 months                                     |
| P13 | Female | MA Design Informatics  | B2 | < 1 month                                    |
| P14 | Male   | MSc Design Informatics | C1 | < 1 month                                    |
| P15 | Female | MA Economics           | C1 | < 1 month                                    |
| P16 | Female | MSc Design Informatics | C1 | 2 months                                     |
| P17 | Female | MA Design Informatics  | C1 | 1 month                                      |
| P18 | Female | MA Education           | C1 | < 1 month                                    |
| P19 | Female | MA Philosophy          | C1 | 1 month                                      |
| P20 | Male   | BSc AI & CS            | B2 | > 6 months, but no contact with UK services* |

We recruited 20 participants for the WoZ experiment. Their demographic information is shown in Table 8.4. 3 male and 17 female participants participated in the experiment. 2 participants were undergraduates, and the others were studying at the master's level. Participants studied a wide range of subjects, such as computer science, design, education and philosophy. All participants can either speak English at the vantage (CEFR B1) or the advanced level (CEFR C1). All of them were able to communicate in English effectively in academic and daily settings. Due to identifiability issues, we omitted to report the age of each participant. The ages of participants ranged between 21 to 28, with an average age of 24 and a median age of 23. None of the participants was aware of the human wizard when participating in the experiment; however, 7 of them expressed their suspicions after the disclosure of the human wizard, either because of the delay or the intelligence in answering open questions at the end stage of the conversation.

### 8.3.3 Data collection and analysis

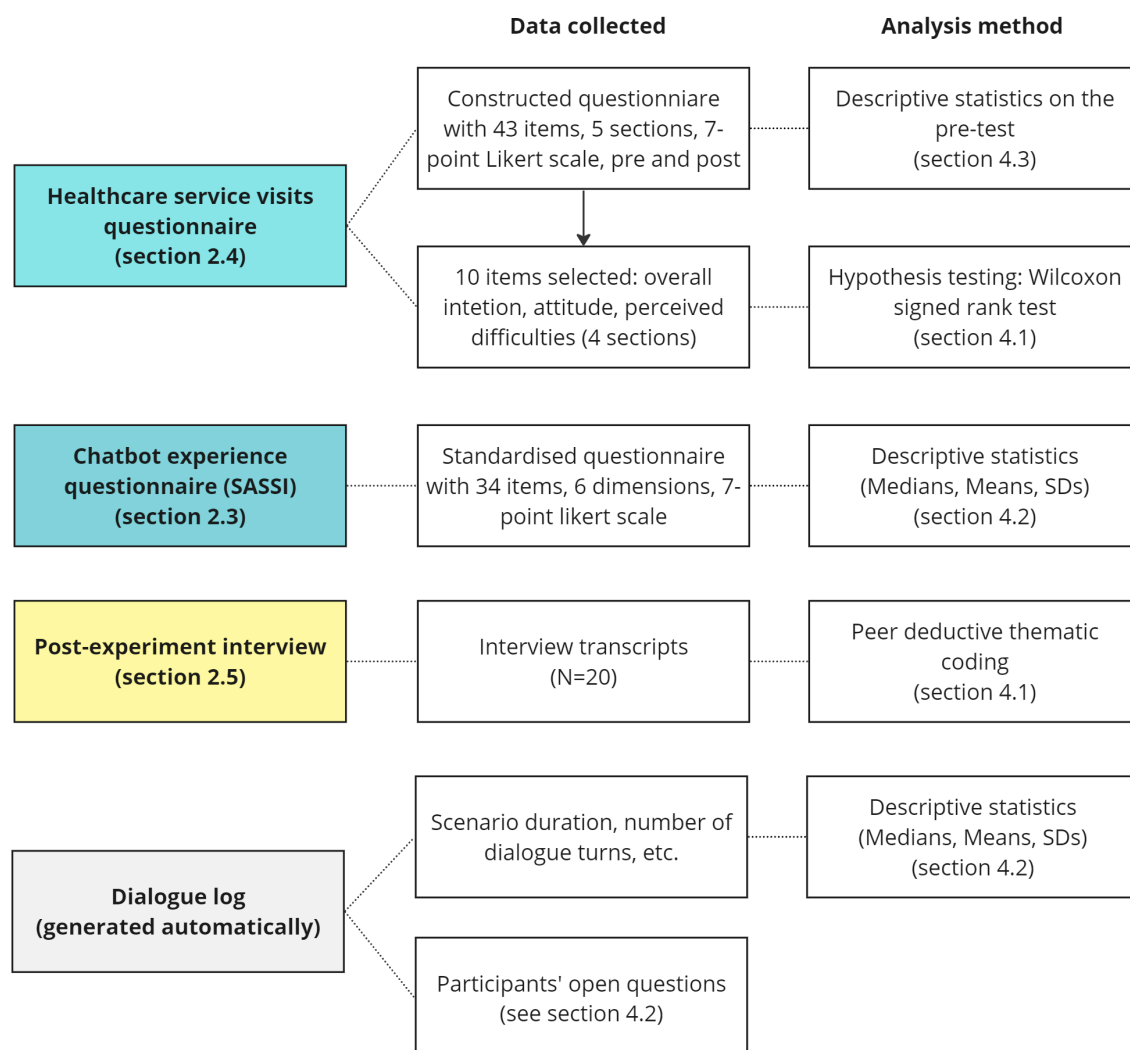


Figure 8.3 Overview of the data collection and analysis. We collected quantitative data from the healthcare service visits questionnaire (cyan) and the SASSI questionnaire (dark cyan). We collected qualitative data from the post-experiment interviews (yellow). Dialogue logs were generated automatically from the chatbot system (grey). The colour-filling in this figure corresponds to the colour-filling used in Figure 8.1 to indicate corresponding sections.

We collected the experiment data from 4 sources: the numeric results from the pre- and post-healthcare service visits questionnaires, the numeric results from the SASSI questionnaires, the audio transcripts from the post-experiment interview, and the system log data generated from the chatbot. The overview of the experiment data and their respective analysis method are shown in Figure 8.3.

For the pre- and post-healthcare service visits questionnaire, we pre-determined 10 items in the questionnaire to answer hypotheses H1, H2 and H3 (see Section 8.2.2 for

the explanation of choice). The choice of items was made after the questionnaire construction and before the data collection. Wilcoxon-signed rank tests (paired sampling, one-way) were performed to examine the differences across 10 questionnaire items before and after the chatbot interaction. The Wilcoxon-signed rank test was suitable because it is a non-parametric hypothesis testing method, and our sample size is relatively small ( $N=20$ ), which may not follow the normal distribution. The 10 pairs of questionnaire items (before and after) were tested separately. The order of testing is illustrated in Figure 8.4.

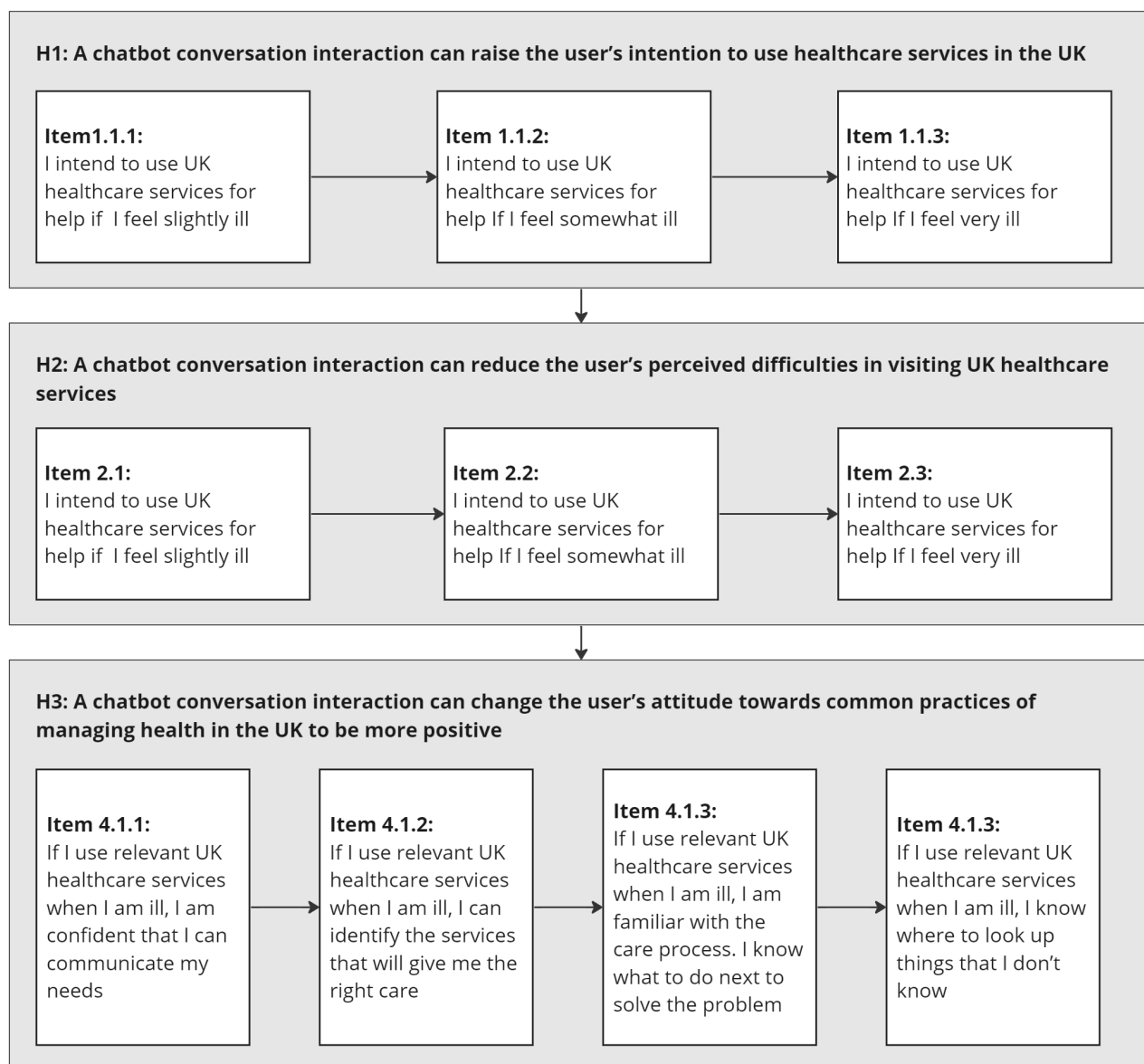


Figure 8.4 The sequence of hypothesis testing. We run 10 hypotheses consecutively, in the order of items that are associated with H1, then those with H2 and H3.

Since we ran multiple hypothesis tests consecutively to test questionnaire items, we used the Holm-Bonferroni correction to deal with familywise error rates (Holm, 1979). The Holm-Bonferroni correction reduces the possibility of getting a statistically

significant result by chance (i.e., Type I errors) while maintaining the statistical power (i.e., reduces Type II errors) compared to the naïve Bonferroni correction. The corrected alpha level of each questionnaire item is dynamically adjusted according to the ranked significance levels (i.e., P-values) of all tested questionnaire items, from the lowest P-value to the highest P-value.

We used the Rosenthal (1994) approach to calculate the effect size of the Wilcoxon signed-rank test,  $r$ . The effect size  $r$  measures the degree of the difference before and after the chatbot interaction. The  $r$  value varies from 0 to close to 1. The effect size  $r$  is interpreted as small if it falls between 0.1 to 0.3 (exclusive), and it is interpreted as moderate if it falls between 0.3 and 0.5 (exclusive). The effect size  $r$  is interpreted as large if it is equal to or greater than 0.5.

We used the R programming language (*R: The R Project for Statistical Computing*, 2023), version 4.3.0 and its build-in package in the RStudio environment (version 2023.06.0 Build 421) to perform the Wilcoxon-signed rank tests and then compared the P-value of each questionnaire item with its associated corrected alpha level to examine whether this hypothesis was verified or not. Apart from hypothesis testing, we also computed the mean and standard deviation of all 43 questionnaire items of both pre- and post-questionnaires across 20 participants. These were calculated using Microsoft Excel.

For the SASSI questionnaire, as shown in Table 8.2, 34 questionnaire items were grouped into 6 dimensions. In this questionnaire, some statements are negatively phrased. For example, for the system response accuracy, item 1 is “the system is accurate”, whereas item 2 is “the system is unreliable” (see Appendix E3 for the full questionnaire). We inverted the results of those negatively stated items and then calculated the aggregated mean and standard deviation of each dimension using Microsoft Excel.

For the post-experiment interview, we first transcribed the audio recording and anonymised personal information such as names, subject areas, and locations and replaced them with pseudonyms. Then, we carried out the thematic analysis with a deductive coding approach. The reason for using the deductive approach is that those qualitative codes can be easily deduced from the healthcare service visits and the SASSI questionnaires. The codebook is structured based on the theory of planned behaviour for healthcare service visits. It includes codes that capture intentions, attitudes, and perceived difficulties for healthcare service visits. It additionally includes codes that capture user experiences of the chatbot system. The full codebook is shown in Appendix E5. We used the parallel coding approach to code all interview transcripts. Two coders code the same interview transcript independently and then discuss the coding results afterwards. We used the NVivo software (*Best Qualitative Data Analysis Software for Researchers / NVivo*, 2023) to document the final coding results. Since

the second coder for the qualitative analysis does not speak Mandarin, raw transcriptions were translated into English by using Microsoft Word's built-in translation function. During the analysis, both coders refer to the original Mandarin transcripts to disambiguate interpretations.

The chatbot system logs participants' behavioural data during the interaction. The purpose of the log data is to illustrate the user interaction quantitatively. The log data includes the total duration of a WoZ session, the number of dialogue turns of a WoZ session, the number of runs (from the start to the end) that a participant had gone through in a WoZ session and open questions that the participant had asked in the WoZ session. These raw data were stored in an SQLite database and were exported to Microsoft Excel for further analysis. We computed the average, standard deviation, maximum, and minimum with regard to the total duration, the time spent per dialogue turn, and the time spent per run (from the start to the end) of 40 WoZ sessions across 20 participants. We also calculated these descriptive statistics with respect to each use case scenario.

## 8.4 Results

### 8.4.1 Hypothesis testing

In this section, we present items that we chose from the healthcare service visits questionnaire to answer H1, H2 and H3 (Section 8.2.2). Although we conducted multiple hypothesis tests consecutively, here we grouped the results based on each hypothesis.

**[H1]:** A chatbot conversation interaction can raise the user's intention to use healthcare services in the UK.

The results for H1 are summarised in Table 8.5. 3 questionnaire items were tested for this hypothesis: the intention to use UK healthcare services if the participant is slightly ill (i.e., conditions that do not affect daily life), somewhat ill (conditions that somehow affect daily life), and very ill (conditions that affect daily life significantly). We report the median instead of the mean because the Wilcoxon signed rank test is non-parametric.

Wilcoxon signed rank tests (one-way) showed that there were no significant changes in the intention for healthcare service visits. The rise in intention, between before and after the chatbot interaction across slight ill ( $Z=1.8671$ ,  $p>0.05$ , with correction), somewhat ill ( $Z=-0.8890$ ,  $p>0.05$ , with correction), and very ill ( $Z=-0.8815$ ,  $p>0.05$ , with correction) was not significant. All median scores roughly stayed at the same level. For

slightly ill, the median scores before and after the chatbot interaction are 2 and 2.5, with a moderate-sized effect ( $r=0.464$ ). This means participants did not intend to use healthcare services if they were slightly ill (i.e., disagreed with the statement), and the effect of the chatbot interaction is limited. For somewhat ill, the median scores before and after the chatbot interaction are both 5 (i.e., somewhat agree with the statement), with a small effect size ( $r=0.171$ ). This suggests participants may intend to visit relevant healthcare services if they were somewhat ill, regardless of the chatbot interaction. For the very ill, the median scores before and after the chatbot interaction are 6 and 6.5 (i.e., agree with the statement), with a small effect size ( $r=0.208$ ). This shows that participants highly intended to use healthcare services if they were very ill, and independent of the chatbot interaction. Overall, H1 is not supported.

Table 8.5 Hypotheses testing results for H1. The table shows the median scores of questionnaire items before and after the chatbot interaction. The score ranges from 1 (strongly disagree with the statement) to 4 (neutral or I do not know) and then to 7 (strongly agree with the statement). The standardised test statistic (Z), the exact p-value, the  $\alpha$ -level at the 0.95 confidence level with Holm-Bonferroni correction, and the Wilcoxon effect size  $r$  are also shown. Values with asterisk marks (\*) indicate significance or a large effect size. Overall, none of the questionnaire items changed significantly before and after the chatbot interaction. Thus, H1 is not supported.

| Question                                                                | Median (before) | Median (after) | Z-value   | P-value   | Corrected $\alpha$ -level | Effect size $r$ |
|-------------------------------------------------------------------------|-----------------|----------------|-----------|-----------|---------------------------|-----------------|
| 1.1.1 I intend to use the UK healthcare service for help (Slightly ill) | 2               | 2.5            | Z=-1.8671 | p=0.03074 | 0.0125                    | r=0.464         |
| 1.1.2 I intend to use the UK healthcare service for help (Somewhat ill) | 5               | 5              | Z=-0.8890 | p=0.187   | 0.025                     | r=0.171         |
| 1.1.3 I intend to use the UK healthcare service for help (Very ill)     | 6               | 6.5            | Z=-0.8815 | p=0.189   | 0.05                      | r=0.208         |

Figure 8.5 illustrates the distributions of scores of the 3 questionnaire items of H1. For Q1.1.1 (slightly ill), the interquartile range (IQR) before the chatbot interaction is between score levels 1 and 4.25; the IQR after the chatbot interaction is between score levels 2 and 5. This confirms that most participants would not want to attend healthcare services if they were slightly ill. Some participants increased their score level after the chatbot interaction, mainly increasing from 1 to 2 or 2 to 5. However, other participants either maintained the same score level or decreased their score

level (2 participants) after the chatbot interaction. The IQR and the trends show that the effect of the chatbot is relatively small and insignificant.

For Q1.1.2 (somewhat ill), the IQR before the chatbot interaction is between score levels 2.75 and 5.25; the IQR after the chatbot interaction is between score levels 3 and 6. Participants have split views on visiting healthcare services if they are somewhat ill, although the overall tendency is in favour of the visit. More participants increased their score level after the chatbot interaction than those who decreased their score level, but most of them remained at the same score level. The effect of the chatbot interaction is relatively small in changing participants' intentions for healthcare service utilisation.

For Q1.1.3 (very ill), the IQR before the chatbot interaction is between score levels 6 and 7; the same range applies to the IQR after the chatbot interaction. This indicates that most participants intend to visit healthcare services in serious illness conditions, and the effect of the chatbot is relatively limited in this situation. Most participants stay at the same score level. This shows that the intentions of healthcare service utilisation for serious illnesses are relatively inflexible.

In post-experiment interviews, many participants felt that the intention of healthcare service visits is strongly associated with the severity of the illness. When considering healthcare service visits, their first reaction is to take into account the condition. P3 claimed that "it depends on how severe the condition is (P3, 82)". P9 suggested that if the condition is minor, she would not manage herself, and if it is serious, he would seek professional help (P9, 67-70). This idea was shared by other participants. P12 mentioned that "there is no need to bother healthcare services if it is not a big deal (P12, 36)". P14 would only use healthcare services if she is seriously ill. Similarly, P15 said that he would resolve health issues by herself first, then ask families and friends instead of booking an appointment with the GP (P15, 18). P16 pointed out that "it is a waste of time to visit healthcare services, and all of the people around me think like this (P16, 16)."

Participants did not change their minds after the chatbot interaction. P3 said, "No, I do not think there is a difference. For example, I sprained my foot a few days ago. For minor issues like this, whether it's now or in the past, I wouldn't go to see professional help. However, if it's a serious problem, whether it's now or in the past, I will seek professional help. The decision is made regardless of the chatbot. (P3, 28)." P20 specifies that his healthcare service visiting behaviour would not change because, for minor illnesses, he worried about delays in treatments (e.g., GP queuing); and for severe illnesses, he has to seek professional help anyway (P20, 120). This idea was shared by P2, even though he learned what the GP can help with, he did not trust the GP to deal with minor problems timely manner (P2, 62). P15 mentioned that, even though the chatbot explains UK healthcare services comprehensively, he still thinks



that UK services are slow. “The chatbot did not give me a definitive answer about how long it takes to be treated, so I would not use them to treat minor problems (P15, 9-12).” However, some participants would consider using UK healthcare services for minor problems in some circumstances. P20 stated that “(even if it is a minor condition), I would visit the GP if I am not certain about the condition (P20, 120).” P7 suggested that she would use GP if she did not have the corresponding medication (P7, 60). In conclusion, interview results confirm that H1 is not supported. The intention of healthcare service visits largely depends on the severity of the illness, and the chatbot conversation did not change participants’ healthcare service visiting behaviour significantly.

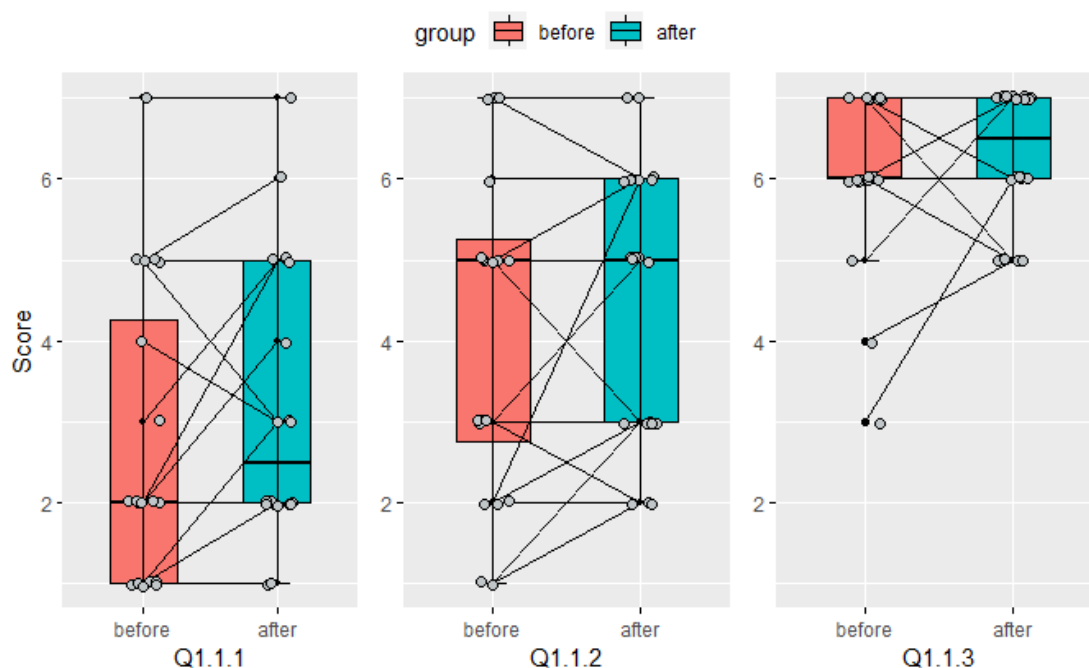


Figure 8.5 Score distribution in box plot and trend of the group of questions that examines H1 (intention to use healthcare services). Q1.1.1 (left – slightly ill), Q1.1.2 (middle – somewhat ill), Q1.1.3 (right – very ill). Score level 1 means strongly disagree with the statement; score level 2 means somewhat disagree with the statement; score level 3 means somewhat disagree with the statement; score level 4 means neutral, or I do not know; score level 5 means somewhat agree with the statement; score level 6 means agree with the statement; score level 7 means strongly agree with the statement.

**[H2]:** A chatbot conversation interaction can reduce the user’s perceived difficulties in visiting UK healthcare services.

The results for H2 are summarised in Table 8.6. 4 questionnaire items were tested for this hypothesis: I am confident that I can communicate my needs (i.e., communication difficulties); I can identify the services that will give me the right care (i.e., organisational difficulties); I am familiar with the care process. I know what to do next to solve the problem (i.e., procedural difficulties); I know where to look up things that

I don't know (i.e., information-seeking difficulties). We report the median of each questionnaire item before and after the chatbot interaction.

Wilcoxon signed rank tests (one-way) suggested that all 4 questionnaire items regarding participants' perceived difficulties have changed significantly before and after the chatbot interaction. For communication difficulties (Q4.1.1), the median increased significantly from 3 (somewhat disagree) to 5 (somewhat agree) ( $Z=-2.7622$ ,  $p=0.00289$  with correction), with a large effect size ( $r=0.63$ ). This shows that participants became more confident in communicating their needs after interacting with the chatbot. For organisational difficulties (Q4.1.2), the median increased significantly from 4 (neutral or I do not know) to 5 (somewhat agree) ( $Z=-2.4706$ ,  $p=0.00676$  with correction), with a large effect size ( $r=0.558$ ). This suggests that participants became more capable of identifying the right healthcare service for resolving problems after interacting with the chatbot. For procedural difficulties (Q4.1.3), the median increased significantly from 2 (disagree) to 5 (somewhat agree) ( $Z=-3.9199$ ,  $p=0.00004$  with correction), with a large effect size ( $r=0.882$ ). This clearly shows that participants become more familiar with the care process in the UK after interacting with the chatbot. For information-seeking difficulties (Q.4.1.4), the median increased significantly from 3 (somewhat disagree) to 6 (agree) ( $Z=-3.503$ ,  $p=0.00023$  with correction), with a large effect size ( $r=0.811$ ). This illustrates that participants became more confident in knowing where to look up health information after interacting with the chatbot. Since there are statistically significant differences across all 4 questionnaire items, H2 is fully supported.

Table 8.6 Hypotheses testing results for H2. The table shows the median scores of questionnaire items before and after the chatbot interaction. The score ranges from 1 (strongly disagree with the statement) to 4 (neutral or I do not know) and then to 7 (strongly agree with the statement). The exact p-value, the  $\alpha$ -level at the 0.95 confidence level with Holm-Bonferroni correction, and the Wilcoxon effect size  $r$  are also shown. Asterisk marks (\*) indicate significance or a large effect size.

| Question                                                           | Median (before) | Median (after) | Z-value     | P-value       | Corrected $\alpha$ -level | Effect size $r$ |
|--------------------------------------------------------------------|-----------------|----------------|-------------|---------------|---------------------------|-----------------|
| 4.1.1 I am confident that I can communicate my needs               | 3               | 5              | $Z=-2.7622$ | $p=0.00289^*$ | 0.00625                   | $r=0.63^*$      |
| 4.1.2 I can identify the services that will give me the right care | 4               | 5              | $Z=-2.4706$ | $p=0.00676^*$ | 0.00714                   | $r=0.558^*$     |
| 4.1.3 I am familiar with the care process. I know what             | 2               | 5              | $Z=-3.9199$ | $p=0.00004^*$ | 0.005                     | $r=0.882^*$     |

|                                                        |   |   |          |            |          |          |
|--------------------------------------------------------|---|---|----------|------------|----------|----------|
| to do next to solve the problem                        |   |   |          |            |          |          |
| 4.1.4 I know where to look up things that I don't know | 3 | 6 | Z=-3.503 | p=0.00023* | 0.005556 | r=0.811* |

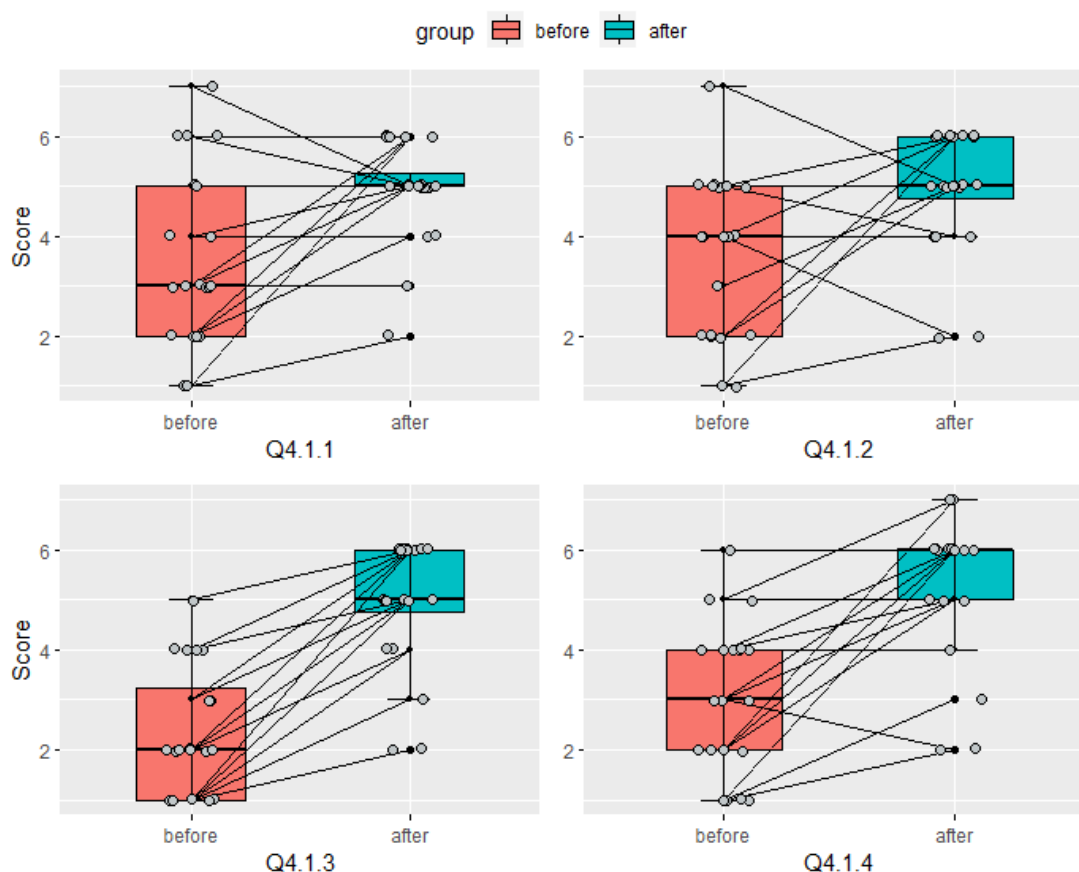


Figure 8.6 Score distribution in box plot and trend of the group of questions that examines H2 (perceived difficulties in using healthcare services). Q4.1.1 (top left - communication difficulties), Q4.1.2 (top right - organisational difficulties), Q4.1.3 (bottom left - procedural difficulties), Q4.1.4 (bottom right - information-seeking difficulties). Score level 1 means strongly disagree with the statement; score level 2 means somewhat disagree with the statement; score level 3 means somewhat disagree with the statement; score level 4 means neutral, or I do not know; score level 5 means somewhat agree with the statement; score level 6 means agree with the statement; score level 7 means strongly agree with the statement.

Figure 8.6 illustrates the distributions of scores of the 4 questionnaire items of H2. For Q4.1.1 (communication difficulties), the interquartile range (IQR) before the chatbot interaction is between score levels 2 and 5; the IQR after the chatbot interaction is between score levels 5 and 5.25. Most participants felt that they were somewhat confident in communicating in healthcare contexts. Particularly, participants who felt not confident became somewhat confident after the chatbot interaction. For Q4.1.2

(organisational difficulties), the IQR before the chatbot interaction is between score levels 2 and 5; the IQR after the chatbot interaction is between score levels 4.75 and 6. Participants who previously felt incompetent (<4) had changed their perceptions after the chatbot interaction. This means participants who felt confused by different healthcare services became more capable of identifying the right care they needed. For Q4.1.3 (procedural difficulties), the IQR before the chatbot interaction is between score levels 1 and 3; the IQR after the chatbot interaction is between score levels 4.75 and 6. Most participants have increased their score levels. This suggests they had learned about the process of treatments for UK healthcare services. For Q4.1.4 (information-seeking difficulties), the IQR before the chatbot interaction is between score levels 2 and 4; the IQR after the chatbot interaction is between score levels 5 and 6. Most participants increased their score level from below 4 to over 4. This suggests that participants became more confident in knowing where to look for health information that they did not know.

The post-experiment interviews also informed a significant change in participants' perceptions of difficulties in visiting healthcare services in the UK. Overall, participants felt that they became more confident in using UK healthcare services. P1 stated that "the chatbot makes me more confident to seek professional help. Now I would prefer to use UK healthcare services instead of managing myself or seeking peers for help (P1, 24)." This is also agreed by many other participants, who became more capable of using UK healthcare services (P11, 14; P15, 16; P16, 26-28; P17, 8; P18, 24). P10 detailed that "the chatbot helped me in many ways, for example, it taught me how to contact the GP, how to speak with doctors and what to do in emergency conditions. It also referenced trustworthy websites for further reading (P10, 22)."

Participants used to be afraid to speak with healthcare professionals. "I was not confident with English, and I did not know what to say, so I felt a bit reluctant to seek professional help (P13, 26)." "I am not saying I distrust doctors in the UK, but I worried that I cannot describe my symptoms and my needs accurately (P1, 22)." This changed after participants interacted with the chatbot. P1 stated that "after chatting with the bot, I would rely more on them. Previously, I was not familiar with UK services, so I rarely thought about these things (healthcare services visits), fearing that I could not do well. Now, I would seek them for help when I need them because I am more confident to speak with them (P1, 22)". P8 mentioned that "I learned how to speak with doctors and nurses. Now I am clearer about what they can offer, so I can make more targeted requests (P8, 6)." P4 suggested that the tips given by the chatbot are useful. "It recommended me to write down all my symptoms before the visit, I think this is a good idea. I can just follow the notes to describe my problem in the consultation (P4, 24)." P20 learned that he may request the interpreter service in situations that he cannot handle (P20, 69).

Another thing that was reported by many participants is that they learned about how healthcare functions in the UK. P1 said, “Previously, I only had a vague impression of the NHS. I do not even know what to do if I am sick, (P1, 12)”. “Now, I know the roles of different services, like in a life-threatening situation, you should dial 999. If you need urgent medical care but it is not as urgent, you should call 111 (P1, 4).” After chatting with the chatbot, P13 claimed that “I felt more secured because I am familiarised about how I would be treated (P13, 18).” P19 realised that “for some prescribed medicines, like (specific) eye drops, you need to see a GP before you can buy them. This is very different from China, where you can simply go to a pharmacy or supermarket to buy them.” Similarly, P6 commented that “the treatment process here is very different from that in China. You can go to see specialists directly in China, whereas you need to book an appointment with the GP, and then ask them to refer you to specialists (P6, 26).” P1 concluded that “I believe, on one hand, the chatbot helps me to understand how the healthcare system operates in the UK. On the other hand, it also boosted my confidence. I feel more capable of booking appointments, making calls to different services, and understanding costs (P1, 4).”

In addition, although the chatbot did not cover all of their concerns, participants knew where to look for relevant information after interacting with the chatbot. “I used to know nothing about healthcare services in the UK. I would be blindly searching for relevant healthcare information online, such as on Baidu or XiaoHongShu, or asking in various WeChat groups. Now, at least, the chatbot provides me with starter links from the official website for me to read further. It makes me feel at ease (P19, 6).”

In conclusion, the interview results confirm that H2 is fully supported. After interacting with the chatbot, participants became more confident in visiting healthcare services in the UK. They felt more capable of speaking with health professionals, and they became more familiarised with the roles and treatment processes of different UK healthcare services, and they knew where to search for health information from official sources.

**[H3]:** A chatbot conversation interaction can change the user’s attitude towards UK healthcare services to be more positive.

The results for H3 are summarised in Table 8.7. 3 questionnaire items were tested for this hypothesis: the overall perceived usefulness of UK healthcare services (Q2.1), the overall impression of UK healthcare services (Q2.2), and the overall perception of the ease of use of UK healthcare services (Q2.3). We report the median of each questionnaire item before and after the chatbot interaction.

Wilcoxon signed-rank tests (one way) suggested that the overall perceived usefulness of UK healthcare services (Q2.1) and the overall impression of UK healthcare services

(Q2.2) did not change before and after the chatbot interaction, whereas participants' overall perception of the ease of use of UK healthcare services had changed significantly after the chatbot interaction (Q2.3). For overall perceived usefulness (Q2.1), there is no significant difference between medians before and after the chatbot interaction,  $Z=-1.8869$ ,  $p=0.0283$  with correction). The median increased from 4 (neutral or I do not know) to 5.5 (somewhat agree); however, the effect size is moderate ( $r=0.445$ ). This suggests that participants maintained a neutral view of the usefulness of UK healthcare services before and after the chatbot interaction. Some participants perceived it to be more positive than others after the chatbot interaction, given that the effect size is moderate. For the overall impression (Q2.2), participants did not change their attitude significantly ( $Z=-1.1767$ ,  $p=0.121$ ) before and after the chatbot interaction. The median increased from 4 (neutral or I do not know) to 5 (somewhat agree), but the effect size was marginally moderate ( $r=0.34$ ). This indicates that participants have a neutral impression towards UK healthcare services, and the effect of the chatbot is limited in changing their impressions. For the overall perception of ease, there is a significant difference ( $Z=-2.446$ ,  $p=0.00714$  with correction) between before and after the chatbot interaction. The median increased from 3.5 (disagree) to 5 (somewhat agree), with a large effect size ( $r=0.511$ ). This suggests that, after interacting with the chatbot, participants perceive a reduced level of difficulty in visiting UK healthcare services.

Table 8.7 Hypotheses testing results for H3. H3 is partially supported.

| Question                                                                                                 | Median (before) | Median (after) | Z-value     | P-value       | Corrected $\alpha$ -level | Effect size $r$ |
|----------------------------------------------------------------------------------------------------------|-----------------|----------------|-------------|---------------|---------------------------|-----------------|
| 2.1 How do you feel about the healthcare services in the UK? (Very useless to Very helpful)              | 4               | 5.5            | $Z=-1.8869$ | $p=0.0283$    | 0.01                      | $r=0.445$       |
| 2.2 How do you feel about the healthcare services in the UK? (Very bad to Very good)                     | 4               | 5              | $Z=-1.1767$ | $p=0.121$     | 0.01667                   | $r=0.34$        |
| 2.3 How do you feel about the healthcare services in the UK? (Very difficult to use to Very easy to use) | 3.5             | 5              | $Z=-2.446$  | $p=0.00714^*$ | 0.00833                   | $r=0.511^*$     |

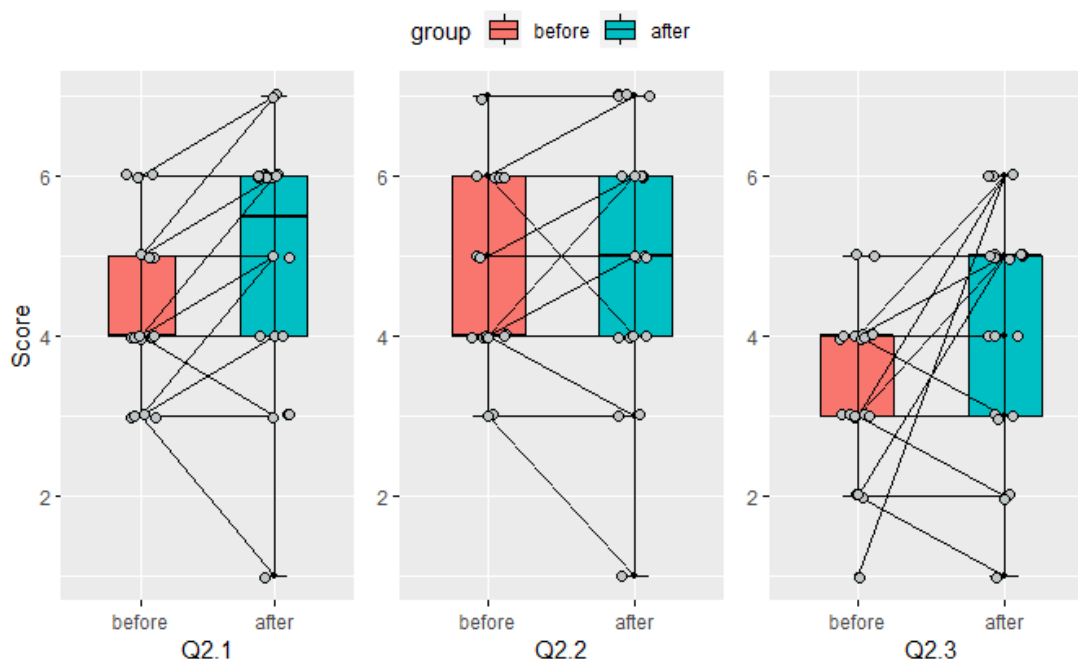


Figure 8.7 Score distribution in box plot and trend of the group of questions that examines H3 (overall attitude to use UK healthcare services). Q2.1 (left – overall perceived usefulness), Q2.2 (middle – overall impression), Q2.3 (right – overall ease of use). Score level 1 means strongly disagree with the statement; score level 2 means somewhat disagree with the statement; score level 3 means somewhat disagree with the statement; score level 4 means neutral, or I do not know; score level 5 means somewhat agree with the statement; score level 6 means agree with the statement; score level 7 means strongly agree with the statement.

Figure 8.7 illustrates the distributions of scores of the 3 questionnaire items of H3. For Q2.1 (overall perceived usefulness), the interquartile range (IQR) before the chatbot interaction is between score levels 4 and 5; the IQR after the chatbot interaction is between score levels 4 and 6. Some participants increased or decreased their score level by 1. However, the majority of other participants stay at the same score level. This suggests that most participants did not change their view of the UK healthcare system significantly. Most participants stayed neutral, whereas some participants became slightly more positive or slightly more negative towards the usefulness of UK healthcare services. For 2.2 (overall impression), both IQRs before and after the chatbot interaction are between score levels 4 and 6. Most participants maintained their score level before and after the interaction, although more participants increased their score level compared to those who decreased their score level. This shows that participants' overall impression of the UK healthcare system was generally neutral, and it is hard to change with our chatbot system. For Q2.3 (overall ease of use), the IQR before the chatbot interaction is between score levels 3 and 4, and the IQR after the chatbot interaction is between score levels 3 and 5. Although some participants maintained their score level, other participants increased their score level significantly.

Most of the increase is more than 2 score levels. This shows that some participants felt that UK healthcare services were easier to use than they had previously thought after interacting with the chatbot.

In post-experiment interviews, participants still hold negative impressions towards UK healthcare services. Participants felt that the UK healthcare services are “slow and difficult to use”. P8 stated “It might be a stereotype, but I felt that the treatment is rather slow. You will only be treated immediately for emergency (P8, 20).” After the chatbot interaction, P13 said, “I do not think the chatbot has changed (my attitude). I learned that seeing a doctor still requires appointments and long waiting times. This is not like you can drop in directly China (P13, 22).”

Participants worried about three things: the long waiting time, the usefulness of non-specialists, and the effort to access specialists. Many participants were concerned about the waiting time. “You have to wait for a long time, and by the time you get to be seen, your illness has already healed on its own (P18, 28).” “The biggest difference (compared to the Chinese system) is that the treatment can be slow (P14, 28)”. “(For minor illnesses), the main concern is whether or not I can receive a timely treatment. (P20, 51)”. Participants also questioned the usefulness of the GP. “They are not domain experts. They can only provide you with some ordinary treatments (P3, 54).” For consultations, P3 felt that “They (the GP) may require you to describe the problem, which means I have to know a lot before going to see them (P3, 58-60)”. P9 worried that the GP would only give oral advice instead of actual treatments (9, 26). As for the effort to access specialists, P4 felt that “I used to think that the UK system was good, but now I think the treatment process is complicated. You can only book an appointment (with the GP), and then be referred to a specialist (P4, 20-22)” “In China, you can just visit a specialist straight away, but here you have to make multiple appointments. This is troublesome (P6, 26)”.

Several participants distrust the UK healthcare system. P6 confirmed her thoughts on the UK health system. “The UK system can be useless, and it needs to take a long time to resolve a health issue (P6, 24)”. P19 added, “I worried that public services can be inefficient, and private ones can be costly (P19, 10).” After interacting with the chatbot, P2 concluded that “I do not trust UK services, and I still do not have high expectations for visits. I do not trust them even if I had a sense of how they work (P2, 62).” “On a broader level, I believe a person’s attitude cannot be changed within a few minutes; on a practical level, the chatbot cannot promise the efficiency and outcome of the use of UK healthcare services, so I remain sceptical (P2, 58).”

Despite negative impressions, participants reported some positive changes in their perception of the ease of use of UK healthcare services. Participants realised that UK healthcare services may be easier to use than they had thought. “They (healthcare service visits) are not that scary (P11, 14).” For GP, P7 stated, “I thought that would be



rather difficult to book an appointment with the GP, and I did not have any positive impressions about it. (After interacting with the chatbot) I feel like it (the treatment process) is not as complicated as I had thought (P7, 18).” Similarly, P5 said, “I was not familiar with the treatment process in the UK. I tended not to use it. Now, I have a general understanding. (At least) I know what to do if I get sick (P5, 10)”. P1 used to prefer managing health problems himself or consulting friends, but now he would like to seek professional help. “Because after you familiarise it, you will not be as timid as before (P1, 12, 40).” P2 reflected that “I still think that it (treatment process) is time-consuming (compared to China), but now I feel more capable in using these services to fulfil my needs (P2, 18).”

The interview results confirm that H3 is not fully supported. Participants hold negative attitudes towards UK healthcare services, and these negative attitudes cannot be changed by our chatbot system. However, the chatbot indeed helps participants familiarise services and treatment processes in the UK. This makes participants feel more capable of utilising healthcare services once they run into health issues.

#### 8.4.2 Dialogue Interaction and User Experience

To know about how participants interact with the chatbot, we first report the dialogue log data to illustrate participants' interaction behaviours. The log data captures dialogue interactions in four ways: the interaction time, the number of dialogue turns, the number of conversation runs from the start to the end, and the number of open questions asked. The purpose of the log data is to describe the chatbot interaction objectively. Then, we report the SASSI scores of participants. The SASSI scores illustrate the participants' subjective satisfaction with the chatbot.

We recorded the choice of use case scenarios, the total duration of each WoZ session (in seconds) and the number of dialogue turns within each WoZ session across 20 participants. For each use case scenario, we calculated the average time participants spent on the use case scenario, the average number of dialogue turns, the average number of conversation runs, the time spent per dialogue turn, and the time spent per dialogue conversation run across those participants who had chosen the use case scenario. We also recorded the total number of open questions asked for each scenario. These results were then aggregated into overall results across the 4 use-case scenarios. Results are shown in Table 8.8.

Table 8.8 Descriptive statistics of dialogue interactions across all participants and their WoZ sessions. The aggregated results are shown in the format: Statistic value  $\pm$ SD [Min, Max].

| Descriptive statistics | Scenario duration (s) | Average number of dialogue turns | Average number of conversation-runs | Time spent per dialogue turn (s) | Time spent per dialogue conversation-run (s) | Total number of open questions asked |
|------------------------|-----------------------|----------------------------------|-------------------------------------|----------------------------------|----------------------------------------------|--------------------------------------|
| Overall average (N=40) | 424 ±178 [136, 881]   | 13 ±5 [6, 23]                    | 2 ±0.8 [1, 3]                       | 34 ±11 [16, 66]                  | 236 ±83 [123, 460]                           | 15                                   |
| Scenario 1 (N=5)       | 325 ±102 [237, 496]   | 12 ±3 [9, 16]                    | 1.4 ±0.5 [1, 2]                     | 28 ±5 [23, 36]                   | 245 ±63 [150, 326]                           | 1                                    |
| Scenario 2 (N=15)      | 495 ±213 [146, 881]   | 13 ±5 [6, 23]                    | 1.9 ±0.8 [1, 3]                     | 40 ±12 [16, 66]                  | 280 ±84 [126, 460]                           | 7                                    |
| Scenario 3 (N=10)      | 350 ±117 [136, 536]   | 14 ±5 [6, 20]                    | 2.3 ±0.8 [1, 3]                     | 26 ±5 [20, 34]                   | 156 ±28 [123, 200]                           | 3                                    |
| Scenario 4 (N=10)      | 442 ±165 [236, 729]   | 13 ±4 [6, 19]                    | 1.9 ±0.7 [1, 3]                     | 35 ±8 [23, 52]                   | 245 ±73 [149, 365]                           | 4                                    |

In terms of the choice of scenarios, 5 participants picked Scenario 1 (the overview of the UK healthcare system) in one of their WoZ sessions. 15 participants chose Scenario 2 (UK medications and self-management) in one of their WoZ sessions. 10 participants chose to explore Scenario 3 (managing urgent conditions) and Scenario 4 (managing minor and chronic illnesses), respectively. On average, participants spent 7 minutes per use case scenario (Mean=424, SD=178), with 13 dialogue turns with the chatbot (Mean=13, SD=5). Participants spent around 34 seconds (Mean=34, SD=11) on each dialogue turn. For each use case scenario, they ran the conversation twice to explore

different dialogue branches (Mean=2, SD=0.8) and spent around 4 minutes per conversation run (Mean=236, SD=83). In total, participants asked 15 open questions across scenarios.

Comparing use case scenarios, participants spent the least time on Scenario 1 on average (Mean=325s, SD=102), as well as the least number of dialogue turns (Mean=12, SD=3). In contrast, participants spent the most time on Scenario 2 on average (Mean=495s, SD=213). This may be because more people (15 vs 5 participants) prefer Scenario 2 (medicine and self-management) over Scenario 1 (overview of healthcare services) when choosing introductory scenarios. The same trend also applies to the number of open questions asked (1 question vs 7 questions). Specific to specified scenarios, there is an even split between Scenario 3 (urgent conditions) and Scenario 4 (GP, minor and chronic conditions). Participants spent more time on Scenario 4 (Mean=350s, SD=117) than Scenario 3 (Mean=442s, SD=165) on average. However, this difference is marginal when it comes to dialogue turns (Scenario 3, Mean=14, SD=5) (Scenario 4, Mean=13, SD=4). The equal trend also applies to the number of open questions asked (3 questions vs 4 questions).

For user satisfaction (i.e., SASSI scores), we calculated the aggregated means and standard deviations of the 6 SASSI dimensions across 20 participants and then calculated the SASSI scores for each use case scenario. The SASSI scores are shown in Table 8.9. Overall, participants feel that the chatbot system can somewhat respond to users' input accurately (system response accuracy, Mean=5.17, SD=0.92). Participants generally feel that the chatbot system is somewhat useful and enjoyable to interact with (likability, Mean=5.4, SD=0.91). They also feel that the chatbot is somewhat easy to operate (cognitive demand, Mean=5.06, SD=0.97). However, the dialogue interaction may be unintuitive, i.e., the interaction may not map to the user's mental model (habitability, Mean=4.42, SD=0.77) and sometimes repetitive (annoyance, Mean=4.61, SD=0.98). In addition, participants feel that the response speed to the user inputs may be slower than their expectation (speed, Mean=4.9, SD=1.55).

The distribution of the overall SASSI scores is shown in Figure 8.8. Most SASSI scores ranged between 4 to 7, which means that participants generally felt positive about the chatbot. However, participants perceived the response speed very differently: 2 participants felt the chatbot response very slowly (between Scores 1 and 2), whereas 2 other participants felt the chatbot response very quickly (between Scores 6 and 7). Most participants felt that the response speed was acceptable (between 4 and 6).

Table 8.9 The SASSI scores across 20 participants over 40 WoZ sessions. SASSI scores are grouped into 6 dimensions: the system response accuracy, likability, cognitive demand, annoyance, habitability, and speed (see Section 8.2.3 for full details). SASSI scores range from 1 to 7. 1 stands for a very negative feeling, 2 stands for a negative feeling, 3 stands for a somewhat negative feeling, 4 stands

for a neutral feeling, 5 stands for a somewhat positive feeling, 6 stands for a positive feeling, and 7 stands for a very positive feeling.

| Scenario          | Means ( $\pm$ SD)        |                 |                  |                 |                 |                 |
|-------------------|--------------------------|-----------------|------------------|-----------------|-----------------|-----------------|
|                   | System response accuracy | Likability      | Cognitive demand | Annoyance       | Habitability    | Speed           |
| Overall           | 5.17 $\pm$ 0.92;         | 5.40 $\pm$ 0.91 | 5.06 $\pm$ 0.97  | 4.61 $\pm$ 0.98 | 4.42 $\pm$ 0.77 | 4.9 $\pm$ 1.55  |
| Scenario 1 (N=5)  | 5.56 $\pm$ 0.91          | 5.71 $\pm$ 1.11 | 5.00 $\pm$ 1.14  | 5.12 $\pm$ 1.12 | 4.15 $\pm$ 1.01 | 5.20 $\pm$ 1.15 |
| Scenario 2 (N=15) | 4.83 $\pm$ 0.97          | 5.33 $\pm$ 0.90 | 5.16 $\pm$ 1.11  | 4.37 $\pm$ 1.05 | 4.38 $\pm$ 0.73 | 4.53 $\pm$ 1.78 |
| Scenario 3 (N=10) | 5.39 $\pm$ 1.13          | 5.40 $\pm$ 0.90 | 5.40 $\pm$ 0.84  | 4.68 $\pm$ 0.81 | 4.60 $\pm$ 0.67 | 5 $\pm$ 1.68    |
| Scenario 4 (N=10) | 5.26 $\pm$ 0.87          | 5.45 $\pm$ 1.07 | 4.70 $\pm$ 1.02  | 4.62 $\pm$ 1.17 | 4.44 $\pm$ 1.00 | 5.20 $\pm$ 1.46 |

For introductory scenarios, participants were generally more satisfied with Scenario 1 (the overview of the UK healthcare system) than Scenario 2 (UK medications and self-management). Scenario 1 scored on average higher in system response accuracy (Mean=5.56, SD=0.91 vs Mean=4.83, SD=0.97), likability (Mean=5.71, SD=1.11 vs Mean=5.33, SD=0.9), annoyance (Mean=5.12, SD=1.12 vs Mean=4.37, SD=1.05), and response speed (Mean=5.2, SD=1.15 vs Mean=4.53, SD=1.78). Scenario 1 scores in cognitive demand and habitability are only marginally lower than those in Scenario 2 on average (cognitive demand, Mean=5, SD=1.14 vs Mean=5.16, SD=1.11) (habitability, Mean=4.15, SD=1.01 vs Mean=4.38, SD=0.73). Scenario 1 also scores the highest in the annoyance dimension on average (i.e., felt least repetitive), whereas Scenario 2 scores the lowest in the system response accuracy dimension.

For specialised scenarios, there is no obvious difference in satisfaction between Scenario 3 (managing urgent conditions) and Scenario 4 (managing minor and chronic illnesses) on average, except that Scenario 4 requires more effort to explore (cognitive demand, Mean=5.40, SD=0.84 vs Mean=4.7, SD=1.02).

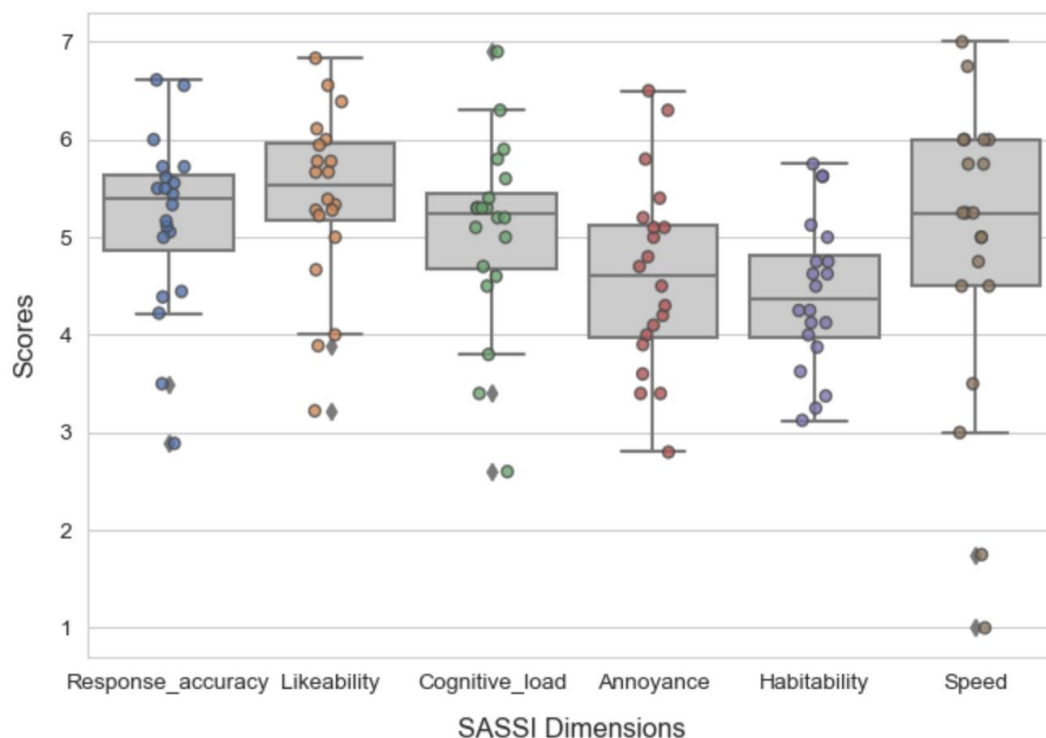


Figure 8.8 The distribution of the scores of the 6 SASSI dimensions across 4 use case scenarios: the response accuracy of the system, the likeability of the system, the cognitive load for using the system, the annoyance of the system, the habitability of the system, and the response speed of the system. SASSI scores range from 1 to 7. 1 stands for a very negative feeling, 2 stands for a negative feeling, 3 stands for a somewhat negative feeling, 4 stands for a neutral feeling, 5 stands for a somewhat positive feeling, 6 stands for a positive feeling, and 7 stands for a very positive feeling.

Looking at the interview results, participants generally felt positive towards the chatbot. Participants particularly liked the chatbot in 3 aspects: useful, responsive and concise. Firstly, they reported that they have learned new things about the UK healthcare system (refer to likeability). One participant reported that she would “rely on herself and the medication she brought”, but now she “knows what to do to seek professional help” after interacting with the chatbot (P1, 12). Similarly, another participant realised the differences in healthcare systems between China and the UK. “In China, we visit the hospital and see a specialist straight away; here we need to see a GP first and only see specialists if necessary (P6, 26)”. Participants also reported that they have learned specific things. One participant learned that some eye drops are restricted in the UK, and she cannot get them without doctor’s prescription (P18, 14). P2 and P10 mentioned that they did not know about the differences between 999 (for life-threatening incidents) and 111 (for non-life-threatening incidents) (P2, 30; P10, 4). When after interacting with the chatbot, P7 stated, “I used to think booking with the GP can be difficult and a waste of time, but after gaining some understanding about it, I think it is not as difficult as I thought, and it can be useful” (P7, 18, 30). “Overall, I

think the chatbot met this aim of introducing me to what the healthcare system is like in the UK (P5, 28)".

Secondly, participants thought that the chatbot was responsive in answering their questions (refer to response accuracy). P5 and P9 claimed that the chatbot can respond quickly and answer their questions accurately (P5, 10; P9, 42). P7 felt the same, "I feel good (about the chatbot interaction) because I can learn directly from the (chatbot's) answer (P7, 12)." P1 stated "For Chinese overseas students, we are not familiar with this system, the chatbot allows me to obtain the information that I want more quickly and accurately, especially when I have specific needs, which is very helpful (P1, 32)". Participants also enjoyed interacting with the chatbot, P9 described the dialogue content to be "colloquial and friendly (P9, 11)". "There are lots of useful information. It is trying its best to help you (P4, 46)".

Thirdly, participants felt that the dialogue content was concise (refers to cognitive demand). P8 stated, "Although I still have to do a lot of research for in-depth matters, it (the chatbot) gives comprehensive assistance while still being able to keep things concise (P8, 24)." Compared to searching for health information online, many participants would prefer to ask the chatbot. P9 felt that asking the chatbot was more convenient (P9, 2). P2 commented that "although all information can also be found from the official NHS website, the chatbot condenses information into short and simple sentences. This indeed helped me to understand information effectively (P2, 42)." P5 felt that reading through web pages takes time and effort as they are written in long paragraphs, but dialogue contents are much shorter (P5, 42). P4 further added that web pages can be hard to navigate, and conversations are more straightforward to find the information she needs (P4, 52-54). P1 imagined that once the technology becomes more mature, it might replace webpages as the primary source to look for health information because it saves effort to do searches (P1, 30).

Despite the overall positive feeling, several drawbacks were identified in the interview. The first one is the user's perception of the chatbot's speed. P2 stated that "the biggest problem with the chatbot is the slow speed. Now, the chatbot prompts sentences one by one on the user's end. Exaggeratedly speaking, I can read a webpage 4 to 5 times while I am waiting (P2, 86, 96)". P18 detailed that "it roughly takes 5-6 seconds to fully display the content in each turn. This is quite suffering (P18, 20)." P20 have the same feeling, but with dialogue control, "I felt that the way the user controls the dialogue is not so efficient. Sometimes, I already knew the content, but I could not skip these sentences. I have to wait for the sentence prompt (i.e., the sentence that displays pre-defined input) to be displayed and then choose what to explore. (P20, 43)".

The second is associated with habitability. Some participants felt that the system's interaction behaviour did not always match what they were expecting. Participants complained that the message prompts did not match their usual reading habits. Some

participants felt that message prompts distract their reading. “(The chatbot) sends messages one after another. Sometimes, the next message pops up when I was still reading the previous message. (P8, 10)”. Others felt that long messages were overwhelming to read. “Sometimes the pop-up message can be very long. This is different from other chatbots, such as Amazon customer service, where they guide you bit by bit. This chatbot presents a lot of information at once. I have to read for a while (P3, 20)”. Another thing that participants have pointed out is the way that the “return” function was implemented. “It should be implemented as ‘one level up’ instead of ‘one step back’, as it was rather confusing if I return twice (chatbot moved to where he was instead of 2 levels up) (P2, 96; P4, 10)”. Participants also stated that it would be better if the chatbot can give them a table of “pre-defined” questions at the start of the conversation because they did not know what follow-up questions were coming, which made them feel that they did not have the control of what to explore (P14, 10, 35-36).

The third one links to the annoyance of the chatbot system. Participants felt that the conversations were repetitive. P16 stated, “It always says repetitive sentences. For example, once I return to the previous (dialogue) turn, it shows the same content again. This is useless and prevents me from finding new content (P16, 6).” P18 described the chatbot as “a rigid bot”, as “the interaction is very mechanical (P18, 18)”. Other participants found the conversation boring. “I think it (the chatbot) is polite and shows the information effectively, but it looks boring like I was reading a long article in the English exam (P17, 6).” P2 described “the way that the chatbot shows information is too ‘stiff’, it is just like reading an official document (P2, 8)”. P3 and P12 expressed their negative feeling about the use of pre-defined questions. “I only have limited choices to explore (P3, 40)” and “I do not have much autonomy when I was exploring use case scenarios (P12, 8).” When asking for future improvements, P3 concluded that “Right now, dialogue contents are indeed useful, but I think the information presentation and dialogue interaction needs to be improved (P3, 62).”

#### **8.4.3 Other findings**

In the grounded theory study, we constructed a framework for Chinese overseas students’ healthcare service visits. In this section, we report results that are not directly linked to chatbot hypotheses but are still associated with Chinese students’ healthcare service visits. We first report on alternative questionnaire items that examine the intention of healthcare service visits and confounding factors that influence the intention. Then, we report on the influence of other people on healthcare service visits. We also go through some attitudes towards specific aspects

of UK healthcare services. The results were extracted from pre-experiment questionnaires, as these results are independent of the effect of the chatbot.

Table 8.10 shows the questionnaire items about the intention of healthcare service utilisation and its confounding factors. When they are ill, participants generally have no preference to visit UK healthcare services in the first place (Q1.2, Mean=4.25, SD=1.68, Median=4.5). Instead, they prefer to use medications that they already know in attempting to resolve their problems (Q1.3, Mean=5.75, SD=0.97, Median=6). When they considered visiting healthcare services, participants claimed that the decision would be made exclusively based on their state of health (Q4.2.1, Mean=5.15, SD=1.73, Median=6). However, at the same time, they worried about non-health-related things that prevent them from utilisation, e.g., schoolwork, language skills, etc. (Q4.2.2, Mean=5.5, SD=1.57, Mean=6).

Table 8.10 Questionnaire items investigate the intention of healthcare service visits and their confounding factors. We report the mean, standard deviation and median for each questionnaire item. Score level 1 means strongly disagree with the statement; score level 2 means somewhat disagree with the statement; score level 3 means somewhat disagree with the statement; score level 4 means neutral, or I do not know; score level 5 means somewhat agree with the statement; score level 6 means agree with the statement; score level 7 means strongly agree with the statement.

| Question                                                                                                          | Mean | ±SD   | Median |
|-------------------------------------------------------------------------------------------------------------------|------|-------|--------|
| 1.2 When I feel ill in the UK, my first reaction is to use relevant UK healthcare services                        | 4.25 | ±1.68 | 4.5    |
| 1.3 When I feel ill in the UK, my first reaction is to solve the problem myself with remedies that I already know | 5.75 | ±0.97 | 6      |
| 4.2.1 When deciding whether or not to use UK healthcare services, I decide only based on the state of my health   | 5.15 | ±1.73 | 6      |
| 4.2.2 When deciding whether or not to use UK healthcare services, I have to worry about non-health-related things | 5.50 | ±1.57 | 6      |

Table 8.11 shows the questionnaire items regarding the influence of others on healthcare service visits. Results suggested that participants did not know whether they were expected to visit healthcare services or not if they were slightly ill (People in the UK - Q3.1.1, Mean=3.55, SD=1.57, Mean=4; friends and family members in China - Q3.3.1, Mean=3.9, SD=1.48, Median=4), although they think that their colleagues, i.e., other Chinese overseas students, would strongly not expect them to visit healthcare services in this situation (Q3.2.1, Mean=2.6, SD=1.54, Median=2). Participants also think that it is common for other people not to visit healthcare services in minor illness conditions (People in the UK - Q3.4.1, Mean=2.9, SD=1.33, Median=2.5; their colleagues - Q3.6.1, Mean=2.3, SD=1.38, Median=2; friends and family members in China - Q3.7.1, Mean=3.15, SD=1.46, Median=3), except that they did not know about the attitude of non-Chinese overseas students (Q3.5.1, Mean=3.6,



SD=1.19, Median=4). This may be because participants did not have much contact with other overseas students at the beginning of their study in the UK.

For the “somewhat” ill condition, participants also hesitated about whether they were expected to visit healthcare services or not. They think that other people would not expect them to visit healthcare services if they are somewhat ill (People in the UK – Q.3.1.2, Mean=4.35, SD=1.39, Median=4; their colleagues – Q.3.2.2, Mean=3.9, SD=1.59, Median=4), except their close friends and family members would expect them to do so (Q.3.3.2, Mean=4.85, SD=1.79, Median=5). Participants were uncertain about how other people behave under somewhat ill conditions (People in the UK– Q.3.4.2, Mean=3.9, SD=1.17, Median=4; non-Chinese overseas students - Q3.5.2, Mean=4.35, SD=1.04, Median=4). Interestingly, they think that their colleagues would not visit healthcare services in the UK (Q3.6.2, Mean=3.4, SD=1.31, Median=3.5); whereas they think their friends and family members would visit healthcare services in China if they were somewhat ill (Q3.7.2, Mean=5.1, SD=1.12, Median=5).

For the seriously ill, it is an established social norm to visit healthcare services. Participants felt that they were expected to visit healthcare services (People in the UK - Q3.1.3, Mean=5.65, SD=0.99, Median=6; their colleagues - Q3.2.3, Mean=5.85, SD=0.88, Median=6). This is especially the case with their families and friends (Q3.3.3, Mean=6.15, SD=1.14, Median=7). The same trend applies to how participants think about other people's behaviour. They think others should visit healthcare services (People in the UK - Q3.4.3, Mean=5.85, SD=0.93, Median=6; non-Chinese overseas students – Q3.5.3, Mean=5.3, SD=1.13, Median=5.5; their colleagues - Q3.6.3, Mean=5.35, SD=0.99, Median=5). This is particularly the case with their friends and families (Q3.7.3, Mean=6.75, SD=0.44, Median=7).

Table 8.11 Questionnaire items that examine the influence of other people on healthcare service visits. We report the mean, standard deviation and median for each questionnaire item. Score level 1 means strongly disagree with the statement; score level 2 means somewhat disagree with the statement; score level 3 means somewhat disagree with the statement; score level 4 means neutral, or I do not know; score level 5 means somewhat agree with the statement; score level 6 means agree with the statement; score level 7 means strongly agree with the statement.

| Question                                                                             |                              | Mean | ±SD   | Median |
|--------------------------------------------------------------------------------------|------------------------------|------|-------|--------|
| 3.1 People who live in the UK would expect me to use UK healthcare services for help | 3.1.1 If I feel slightly ill | 3.55 | ±1.57 | 4      |
|                                                                                      | 3.1.2 If I feel somewhat ill | 4.35 | ±1.39 | 4      |
|                                                                                      | 3.1.3 If I feel very ill     | 5.65 | ±0.99 | 6      |
|                                                                                      | 3.2.1 If I feel slightly ill | 2.6  | ±1.54 | 2      |

|                                                                                                           |                                 |      |       |     |
|-----------------------------------------------------------------------------------------------------------|---------------------------------|------|-------|-----|
| 3.2 Other Chinese overseas students would expect me to use UK healthcare services for help                | 3.2.2 If I feel somewhat ill    | 3.9  | ±1.59 | 4   |
|                                                                                                           | 3.2.3 If I feel very ill        | 5.85 | ±0.88 | 6   |
| 3.3 Friends and family in China would expect me to use UK healthcare services to help                     | 3.3.1 If I feel slightly ill    | 3.9  | ±1.48 | 4   |
|                                                                                                           | 3.3.2 If I feel somewhat ill    | 4.85 | ±1.79 | 5   |
|                                                                                                           | 3.3.3 If I feel very ill        | 6.15 | ±1.14 | 7   |
| 3.4 Based on your experience, people who live in the UK would use UK healthcare services for help         | 3.4.1 If they feel slightly ill | 2.9  | ±1.33 | 2.5 |
|                                                                                                           | 3.4.2 If they feel somewhat ill | 3.9  | ±1.17 | 4   |
|                                                                                                           | 3.4.3 If they feel very ill     | 5.85 | ±0.93 | 6   |
| 3.5 Based on your experience, overseas students, who are not Chinese, use UK healthcare services for help | 3.5.1 If they feel slightly ill | 3.6  | ±1.19 | 4   |
|                                                                                                           | 3.5.2 If they feel somewhat ill | 4.35 | ±1.04 | 4   |
|                                                                                                           | 3.5.3 If they feel very ill     | 5.3  | ±1.13 | 5.5 |
| 3.6 Based on your experience, Chinese overseas students would use UK healthcare services to help          | 3.6.1 If they feel slightly ill | 2.3  | ±1.38 | 2   |
|                                                                                                           | 3.6.2 If they feel somewhat ill | 3.4  | ±1.31 | 3.5 |
|                                                                                                           | 3.6.3 If they feel very ill     | 5.35 | ±0.99 | 5   |
| 3.7 Based on your experience, friends and family in China use healthcare services to help                 | 3.7.1 If they feel slightly ill | 3.15 | ±1.46 | 3   |
|                                                                                                           | 3.7.2 If they feel somewhat ill | 5.1  | ±1.12 | 5   |
|                                                                                                           | 3.7.3 If they feel very ill     | 6.75 | ±0.44 | 7   |

Table 8.12 shows the questionnaire items that investigate participants' attitudes towards aspects of specific healthcare aspects in the UK. The first three questions look at participants' attitudes towards the cost and benefit of visiting healthcare services. Q5.1 examines participants' beliefs about the benefit of visiting healthcare services. We found that participants generally believed that the UK healthcare system is capable of resolving their issues to some degree (Mean=4.7, SD=1.3, Median=5). Q5.2 examines participants' beliefs on the emotional cost of visiting healthcare services. We found that participants generally felt that the use of healthcare services in the UK can be stressful (Mean=5.9, SD=0.97, Median=6). Q5.3 examines participants' beliefs on the time-effort-cost of visiting healthcare services. Results suggested that participants

do feel time and effort-consuming for visiting healthcare services in the UK (Mean=5.5, SD=1.1, Median=6). Q5.4, Q5.5 and Q5.6 investigate participants' thoughts on doctors in the UK. Q5.5 examines participants' perception of doctors' responsibility in resolving health problems. Participants neither agree nor disagree with the idea that doctors are fully responsible for resolving their health issues (Mean=4.35, SD=1.5, Median=4). This suggests that participants either did not know much about doctors' roles or thought that doctors may not be fully responsible for resolving their health problems. Q5.6 examines participants' attitudes in resolving conflicts. The result suggests that participants would respect the doctor's advice and "obey" the advice to some degree (Mean=4.9, SD=1.21, Median=5). Q5.7 examines participants' perceptions of confidence in using UK healthcare services. It shows that they had low confidence and were not familiar with UK services (Mean=3.15, SD=1.31, Median=3). Q5.8 examines the influence of TCM concepts on consultations in UK (Western) healthcare contexts. The result indicates that participants were strongly influenced by TCM concepts, and they were not very confident in using WM concepts to discuss their issues (Mean=2.9, SD=1.74, Median=2).

Table 8.12 Questionnaire items that examine specific attitudes towards individual aspects of UK healthcare services. We report the mean, standard deviation and median for each questionnaire item. Score level 1 means strongly disagree with the statement; score level 2 means somewhat disagree with the statement; score level 3 means somewhat disagree with the statement; score level 4 means neutral, or I do not know; score level 5 means somewhat agree with the statement; score level 6 means agree with the statement; score level 7 means strongly agree with the statement.

| Question                                                                                                                                                               | Mean | ±SD   | Median |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|--------|
| 5.1 Using the UK healthcare system will resolve my health problems                                                                                                     | 4.70 | ±1.30 | 5      |
| 5.2 Thinking of using the UK healthcare system is stressful                                                                                                            | 5.55 | ±1.10 | 6      |
| 5.3 Using the UK healthcare system will need a lot of time and effort from me                                                                                          | 5.9  | ±0.97 | 6      |
| 5.4 When using UK healthcare services, it is the doctor's responsibility to look after me                                                                              | 4.35 | ±1.50 | 4      |
| 5.5 When using UK healthcare services, the doctor will take me seriously                                                                                               | 4.7  | ±1.08 | 5      |
| 5.6 When using UK healthcare services, I will never openly disagree with doctors' advice                                                                               | 4.9  | ±1.21 | 5      |
| 5.7 When using UK healthcare services, I know how they work and what I can expect from them                                                                            | 3.15 | ±1.31 | 3      |
| 5.8 When thinking of using UK healthcare services, I know how to use Western Medicine concepts to discuss my problems instead of Chinese Traditional Medicine concepts | 2.9  | ±1.74 | 2      |

## 8.5 Discussion

### 8.5.1 Implications of Results

This Chapter describes a WoZ experiment to investigate the potential of an educational chatbot in supporting Chinese overseas students to familiarise themselves with healthcare services in the UK and thus aiming to encourage them to visit healthcare services when ill. To examine the effect of the chatbot on students' willingness to visit healthcare services in the UK (i.e., RQ3), we proposed 3 hypotheses and used the results from pre-and-post questionnaires and post-experiment interviews to investigate any positive changes: the intention to use healthcare services in the UK (H1), in participants perception of difficulties for visiting UK healthcare services (H2), in participants' attitude towards UK healthcare services (H3).

H1 is neither supported by the questionnaire results nor the interview results. The questionnaire results suggested no significant changes in participants' intention to visit healthcare services in the UK before and after interacting with the chatbot. Instead, the intention of the visit depends on the illness: participants would not visit if the condition is minor; they may consider visiting if the condition becomes disruptive; they would definitely visit if the condition is severe. The interview results also suggested that the severity of the illness is the fundamental determinant for participants to decide whether to visit healthcare services or not. They think that it might be necessary, and possibly laborious, to visit healthcare services if things are under their control, even if they become more familiarise with the UK healthcare system and know how to use it.

H2 is fully supported by the questionnaire results and triangulated with the interview results. In questionnaires, there are positive significant changes in all 4 aspects of perceptions of difficulties: participants became more confident in communicating their needs to health professionals; they became more capable of identifying the right service; they became more familiar with the treatment process; they knew where to seek healthcare information. In post-experiment interviews, participants suggested that they became more confident in using UK healthcare services. They claimed that the chatbot introduced them effectively to how healthcare services function in the UK. The chatbot teaches them what the services are, how to access them, and what they look like during the treatment. In addition, participants learned ways and tips to talk with healthcare professionals. They also learned where to acquire health information which not covered by the chatbot. After interacting with the chatbot, participants felt more comfortable confronting difficulties, and many of them stated that they would consider using healthcare services in the UK if they felt it necessary.

H3 is partially supported by the questionnaire results and also confirmed by the interview results. The questionnaire results suggested that participants perceived UK healthcare services negatively (i.e., to be useless), and this overall impression cannot be changed by the chatbot. However, participants did find it easier to use healthcare services in the UK after interacting with the chatbot. In post-experiment interviews, participants agreed that UK healthcare services can be “time-consuming” (i.e., waiting time) and “useless” (i.e., no specialists). Although they learned a lot about the roles and treatment processes of UK healthcare services, participants still distrust the UK system (i.e., hard to change their attitude within a short time), and they found it can be complicated to use compared to the Chinese system. However, they felt more capable of using UK services than before, and they would use them if they had to (e.g., illnesses beyond their control).

The results above evidence that the education chatbot can have a positive impact on participants' willingness to use healthcare services in the UK. Specifically, the education chatbot is effective in addressing participants' concerns about visiting UK healthcare services, as H2 is fully supported. The chatbot provides adequate and concise healthcare information to help participants understand the roles and treatment processes of UK healthcare services. They became more capable of confronting difficulties when they were planning to visit UK healthcare services. This positive impact is also reflected in H3, where participants felt easier and became more confident to utilise UK healthcare services after interacting with the chatbot. Our implemented chatbot would be another example to illustrate the effectiveness of using a chatbot to increase self-efficacy in healthcare education, i.e., raise users' confidence to confront health-related problems that they felt unable to resolve previously (Washburn et al., 2016; Milne-Ives et al., 2020).

However, the educational chatbot is not effective in changing participants' attitudes towards UK healthcare services, as reflected by H3. Simply providing healthcare information may not be enough to change participants' attitudes towards the UK healthcare system. As mentioned in the interview, one may become confident about using UK services but still distrust and feel negative about using the system. “I believe a person's attitude cannot be changed within a few minutes. The chatbot cannot promise the efficiency and outcome of the use of UK healthcare services, so I remain sceptical (P2, 58).” In addition to the persistent negative attitude, participants' intention to visit healthcare services is also hardly affected by the chatbot conversation. As shown in H1, participants' intention to visit healthcare services largely depends on the severity of the illness, i.e., the direct motivation for service visits. Participants would visit healthcare services, regardless of difficulties, if they have severe or urgent conditions. However, they would be less likely to seek professional help when they have minor and medium-severity conditions. The educational chatbot helped participants to know what and how to do if they are ill, but it did not change their

subjective motivations to visit UK healthcare services. As a result, although most participants boosted their confidence in using UK healthcare services and would be more likely to use them when necessary, they still prefer to manage healthcare problems themselves first. For future work, alternative strategies should be targeted at changing Chinese overseas students' negative attitudes. For example, designing thought-provocative conversations instead of naïve conversations of health information provision (Roussou et al., 2019).

### 8.5.2 Limitations and Future Work

We conducted a WoZ experiment to evaluate the potential of chatbots to support Chinese students in their healthcare service utilisation. The experiment has a few limitations, particularly in 3 aspects: the design and the scope of the experiment, the choice of questionnaires, and the usability flaws.

The first limitation is regarding the design and the scope of the experiment. We only collected data from 20 Chinese students who had limited healthcare experience and studied at the University of Edinburgh. Some of the dialogue contents were fine-tuned towards the Scotland system, e.g., the procedure to obtain prescribed medications (It is free in Scotland, while not in England). We recruited participants on a rolling basis rather than using the random controlled trial design. This is because we want to evaluate the potential effectiveness of the chatbot prototype and help to inform future chatbot designs. The results from the study only reflect the reality of our participants. It may not represent the entire Chinese overseas student population in the UK and beyond.

The second limitation is the use of questionnaires. We used a self-constructed questionnaire to investigate participants' healthcare service visiting behaviour. Although we followed the construction steps to investigate participants' healthcare service visiting behaviour according to Ajzen's theory of planned behaviour (2006), we did not fully validate this questionnaire due to time and resource constraints. Alternative to self-construction, there are pre-existing standardised questionnaires to measure health behaviours. For example, the Health Behavior Questionnaire (Shabany et al., 2018), the Health Promoting Lifestyle Profile (S. N. Walker et al., 1987), the Medical Outcomes Study Social Support Survey (Sherbourne & Stewart, 1991), and the EuroQol-5 Dimension questionnaire (Obradovic et al., 2013). However, most of them look at general health habits and include aspects that are irrelevant to the use of healthcare services, such as lifestyle questions about sleeping, smoking, exercise, the current state of physical and mental health, or community support. To our knowledge, the only standardised questionnaire that looks at the use of healthcare services is the Patient Activation Measure questionnaire (Hibbard et al., 2004). However, this questionnaire focused on the patient's engagement with healthcare services in the

context of chronic illnesses. It expects the survey answerer to engage with the healthcare system at least once. The questionnaire aims to examine the patient's attitudes and feelings in taking further actions. This does not fit our study as our participants are healthy and have had no contact with the healthcare system. Also, it is not designed to examine intentions and their associated factors of healthcare service use. The questionnaire only measures the confidence to use healthcare services while neglecting other aspects such as the perceived usefulness, social influences, etc.

For the chatbot interaction experience, we used the SASSI questionnaire to collect users' subjective experiences. We use this questionnaire because we would like to measure participants' subjective satisfaction. Collecting subjective feelings will allow us to know how participants think about the chatbot, and we can make improvements to make future iterations more useful and enjoyable to interact with. Alternative questionnaires such as PARADISE (M. A. Walker et al., 1997) focus exclusively on measuring task completions, whereas AttrakDiff (Hassenzahl & Monk, 2010) focus exclusively on hedonic emotions. Some questionnaires focus on the speech aspect of the conversation agent rather than the dialogue aspect, e.g., MoS (Schmidt-Nielsen, 1992) and SUI SQ (Polkosky, 2005). The System Usability Scale (SUS) can be used to measure the system's usability; however, its questions may be too general for measuring the experience of dialogue systems. Although SASSI is the most suitable questionnaire in our study, its scores are not comparable between systems. There is no baseline metric for the SASSI scores so it is hard to tell how fine-grained our chatbot prototype is.

The third limitation is associated with the chatbot prototype's implementation. Participants reported many usability problems, such as the current implementation of the "return" function being confusing and the way of message pop-ups being disruptive. Another commonly reported problem is the "intelligence of the chatbot". Participants expect to have more freedom in exploring the chatbot content. They want to "jump into" the information that they are interested in directly rather than going through pre-defined flows of conversations. After their first conversation run, participants could easily feel that the interaction was repetitive.

### 8.5.3 Conclusion

In this chapter, we used a WoZ experiment to investigate the effectiveness of an educational chatbot prototype that aims to "positively affect Chinese overseas students' willingness to visit healthcare services in the UK", i.e. RQ3. Findings from this study show that the chatbot is capable of helping participants understand and familiarise the roles and treatment processes of UK healthcare services, thus boosting

their confidence to seek professional help. However, the chatbot did not affect Chinese students' attitudes towards UK services and their intentions to visit these services. This chatbot prototype illustrated the potential of an educational chatbot in boosting self-efficacy in healthcare service visits. The key contribution of this chapter is listed below.

1. Evaluated an educational chatbot to show the potential of chatbots to help with Chinese overseas students' healthcare service visits. The result opens up a design space to support healthcare service visits.
2. Illustrated a way of using chatbots to support Chinese students. A chatbot can be designed to provide tailored and concise healthcare information. This may boost students' confidence in visiting healthcare services. They would be more likely to seek professional help once they feel it is necessary.
3. Highlighted the limitation of the current design of the chatbot (i.e., cannot change attitude and intentions effectively). Suggested potential directions to change Chinese students' attitudes towards healthcare services in the UK, e.g. adding provocative conversations.



## Chapter 9: Discussion

### 9.1 Introduction

Chinese international students tend to underutilise healthcare services when they feel discomfort (Sproston et al., 2001; Ellis-Bosold, 2013; Magnúsdóttir & Thornicroft, 2022). They face a number of challenges, including language, communication (Håkonsen et al., 2014; Schouten & Meeuwesen, 2006), service unfamiliarity (Galanis et al., 2013; Czapka & Sagbakken, 2016), lack of support (Z. Li, 2016), and the need to change their health beliefs and practices that they were used to (Sproston et al., 2001). They are also experiencing rapid changes in social environments (Wei et al., 2007a; D. Wang, 2017) and hold negative attitudes towards UK healthcare services (Section 6.4.3). These challenges make Chinese overseas students particularly vulnerable when they experience discomfort; they seek alternative help instead of getting help from healthcare professionals (Ching et al., 2017; Law, 2021; Magnúsdóttir & Thornicroft, 2022).

In this thesis, I confirmed that Chinese overseas are reluctant to utilise healthcare services in the UK. Given the potential benefits of chatbots, i.e., accessibility, interactivity and the ability to promote behaviour changes, I designed and implemented a chatbot prototype that helps Chinese students become familiar with UK healthcare services and prepare for consultations.

The chatbot design and implementation followed a three-stage HCD process. First, I used the grounded theory method to understand the Chinese overseas students' health management behaviour, particularly about their decisions in utilising healthcare services in the UK (Chapters 4 & 5). Then, I used the Co-design workshop to uncover Chinese students' detailed pain points in their service utilisation journeys (Chapter 6). Based on the discovered pain points, I designed and implemented a chatbot prototype (Chapter 7) and set up a mixed-method WoZ study to evaluate its effectiveness in addressing Chinese students' reluctance to utilise healthcare services (Chapter 8). The implemented chatbot prototype illustrated its potential to boost Chinese students' confidence and to influence their attitude towards healthcare service utilisation.

In this chapter, I will provide a summary of key results and contributions of the thesis, focusing on answering the three main research questions listed in Chapter 1. Then, I discuss our achievements, limitations and how the chatbot prototype fits into existing practices to support healthcare service utilisation. I will also outline future directions to improve our chatbot prototype and suggest other ways to support healthcare service utilisation.

## 9.2 RQ1 Understanding Chinese Overseas Students: How do they make decisions about using healthcare services in the UK?

In Chapter 4 (Section 4.3), I reflected on two of my experiences with UK healthcare services: emergency dental care and my first visit to the GP. Chapter 5 expands on these topics to elicit how other Chinese overseas students manage their health and well-being and how they make decisions about utilising healthcare services. We found three key determinants: 1. “Perceived difficulties to use”, 2. “Attitude towards UK healthcare services”, 3. “Social influences”. This fits the Theory of Planned Behaviour framework (Ajzen, 1991). Chinese overseas students make healthcare service utilisation decisions based on three aspects: beliefs about their ability to overcome difficulties in accessing healthcare services, thoughts on expected returns, and views and behaviours of others. Our findings extend existing studies in describing the phenomenon of Chinese international students accessing healthcare services, e.g., Ellis-Bosold (2013), Wang (2017) and Magnusdottir and Thornicroft (2022). We proposed a conceptual framework to explain how Chinese overseas students make healthcare service utilisation decisions (Section 5.4.1). This framework is then used as the theoretical basis to design our chatbot intervention. To encourage healthcare utilisation, interventions should consider: 1. Reducing students’ perceived difficulties in accessing care, 2. Changing students’ attitudes towards services or 3. Creating supportive social environments.

### 9.2.1 RQ1.1: How do Chinese overseas students manage health and well-being in the UK?

#### **In particular, what do they do when they feel discomfort?**

Chapters 4 and 5 (Sections 4.3 and 5.3) showed that students are reluctant to utilise healthcare services when ill. Students prefer to self-intervene (e.g., taking medicines that they brought from China) or seek help from their peers (e.g., sharing medicines) over seeking professional help. They would be reluctant to visit health services unless necessary. Results from this thesis align with other studies (Xin, 2016; Magnusdottir & Thornicroft, 2022), confirming the gap between feeling discomfort and utilising healthcare services. We showed that this reluctance is not limited to mental health issues (Bansal et al., 2014; Magnusdottir & Thornicroft, 2022); the same pattern also applies to physical illnesses. This finding helps to explain why Chinese overseas students have a low rate of healthcare service utilisation (Ellis-Bosold, 2013; Porter, 2021).

### **9.2.2 RQ1.2: What are the attitudes that Chinese overseas students hold towards UK healthcare services?**

Chinese overseas students generally hold a negative attitude towards UK healthcare services. In Chapter 4, I resisted using UK healthcare services as I felt uncertain, anxious and worried when I first thought about accessing UK services. In Chapter 5, many students complained about the NHS being slow and ineffective in resolving their problems. Due to mismatches in expectations, students often felt undervalued when receiving treatments and dissatisfied with the quality of the service. These findings align with other studies, confirming that Chinese overseas students hold overall negative impressions towards UK healthcare services (Tang et al., 2012; D. Wang, 2017). This discovery highlighted that students' thoughts and opinions are contributing to the reluctance to utilise healthcare services.

### **9.2.3 RQ1.3: What kind of underlying difficulties prevent Chinese overseas students from using healthcare services in the UK?**

Chinese overseas students face a number of obstacles when considering utilising UK healthcare services. In Chapter 4, I reflected on the limited knowledge and communication skills in healthcare contexts, unfamiliarity with UK healthcare services, emotional reluctance and demanding effort to search for health information. In Chapter 5, interviewees expressed similar concerns about difficulties in language and communication (c.f. knowledge and communication skills), organisational disorientations (c.f. unfamiliarity with UK healthcare services) and fears and cognitive burdens in specific situations (c.f. emotional reluctance). Additionally, they also expressed the difficulty of seeking external support, i.e., hard to seek other people to assist them in reaching healthcare services, as they do not have established interpersonal connections and social resources to do so. Sociocultural matters also impede students' decisions in utilising healthcare services in the UK, such as the desire to stick with TCM practices, differences in dynamics between patients and doctors, differences in living styles, and cultural taboos. Our results align with other studies, illustrating a variety of barriers to accessing care (H. Chen et al., 2020; Ching et al., 2017; J. Li et al., 2016; Lu et al., 2014; Tang et al., 2012; Thomson et al., 2006; D. Wang, 2017; I. K.-H. Wang, 2018). However, different from other studies, which mostly studied in the field of mental health. We found that those barriers are prevalent across illnesses, and those perceived barriers play an important role when students make decisions to utilise healthcare services.

### 9.3 RQ2: How can a chatbot be used to address problems that Chinese overseas students have in their use of healthcare services in the UK?

In Chapter 6, I conducted Co-design sessions with Chinese overseas students to investigate pain points in their healthcare journeys and to figure out students' needs to use chatbots to address the healthcare service utilisation problem. We found: 1. Unfamiliarity with UK services and medicines, 2. Insufficient language and communication skills, 3. Insufficient resources and support from NHS as the three main groups of pain points. Students proposed to use chatbots in five ways: 1. Answering medical enquiries (address pain point 1), 2. Educating for treatment and consultations (address pain point 1), 3. Contacting healthcare workers (address the pain point 3), 4. Translating medical terminologies (address pain point 2), and 5. Overcoming psychological reluctance. Unlike other studies, which primarily focused on revealing specific difficulties and needs (Wei et al., 2007a; Ellis-Bosold, 2013; Lu et al., 2014; Porter, 2021), this study expands beyond identifying barriers to examine actionable points that students wish to change. Findings from Chapter 6 elicited detailed user requirements to shine a light on ways to design and implement an effective chatbot system tailored to Chinese students' needs.

#### 9.3.1 RQ2.1: What are the healthcare utilisation journeys that Chinese overseas students have experienced?

Students illustrated four types of healthcare journeys. They contact healthcare services to 1. Deal with administrative matters, 2. Resolve minor symptoms, 3. Manage chronic conditions, 4. Handling urgent and emergency conditions. This study expands on works on Chinese students' utilisation of mental health services (Wei et al., 2007a; Z. Li, 2016; Law, 2021) and utilisation of primary care services (Ellis-Bosold, 2013; Porter, 2021), by incorporating more kinds of Chinese students' healthcare utilisation journeys. Findings were used to design use case scenarios in Chapter 7.

#### 9.3.2 RQ2.2: What are the pain points in these healthcare journeys?

There are three groups of pain points: 1. Pain points associated with unfamiliarity with UK healthcare services, treatments, and medicines, 2. Pain points associated with insufficient language and communication skills to tackle healthcare contexts, 3. Pain points associated with insufficient resources and support from NHS. Many of the pain points from Groups 1 and 2 overlapped with negative attitudes and utilisation barriers in Chapters 5 and 6 (Section 5.3.2.1 and Section 6.4.3.1). Group 3 was a new set of pain points to reflect NHS's internal problems. The NHS's service unavailability,

unresponsiveness and insufficient care and support lead to students' dissatisfaction in their healthcare journeys. This finding coincides with suggestions from other immigrant studies, which advocate providing sufficient services and tailored support (Dias et al., 2011; De Luca et al., 2013; O'Donnell et al., 2016). These three groups of pain points were used to inform the dialogue content in Chapter 7.

### **9.3.3 RQ2.3: How would Chinese overseas students like to use chatbots to support them in using UK healthcare services?**

Students proposed five ways of using chatbots: 1. Answering medical enquiries, 2. Educating them to become familiar with treatments and prepare for consultations, 3. Facilitating better interactions with healthcare workers online, 4. Translating medical terminologies during consultations, and 5. Providing emotional reassurance. The first and second ways of using chatbots address pain points associated with becoming familiar with treatment and consultation processes in the UK; the third way of chatbot use is linked to the pain point of insufficient resources and support from NHS. The fourth way of chatbot use addresses pain points related to language and communication. While the last way of chatbot use does not relate to any groups of pain points in the workshop, it reflects the need for support in overcoming fears, which is a key barrier to healthcare service utilisation mentioned in Chapters 4 and 5.

### **9.4 RQ3: How has the chatbot we created impacted Chinese overseas students' willingness to use healthcare services in the UK?**

In Chapter 7, I implemented a chatbot prototype to educate newcomers, helping them to become familiar with services and prepare for consultations. I chose to address this context because it is achievable given the resources we have, and at the same time, it addresses many problems that are prevalent to the Chinese overseas student population, covering many pain points associated with unfamiliarity with UK services, and some pain points associated with insufficient communication skills (RQ2.2). The implemented chatbot prototype contains four scenarios: 1. Overview of the UK healthcare services, 2. Self-intervention and medications, 3. Managing urgent conditions and emergencies, and 4. Managing minor and chronic conditions. These scenarios cover popular healthcare journeys of Chinese overseas students, which were illustrated in RQ2.1.

In Chapter 8, I deployed the chatbot prototype in a mixed-method WoZ study to evaluate its effectiveness in changing students' intentions of healthcare service utilisation. Results showed that although the chatbot prototype did not change their overall willingness to use UK services, it made them feel more capable and confident

in using them. Results evidenced that the implemented chatbot had a positive impact on students' intention to utilise healthcare services. However, it did not affect students' attitudes towards UK services. The implemented chatbot demonstrated the potential to use it as a way to encourage Chinese students against their reluctance to utilise healthcare services. Compared to other dialogue systems for promoting health behavioural changes, our implementation is simple but effective. It provides introductory information to help students familiarise themselves with UK services and consultations. This significantly reduces students' perceived barriers to accessing care. The chatbot prototype triangularised with one of the core implications in Chapter 5 (Section 5.4.3), showing the effectiveness of encouraging healthcare utilisation by reducing students' perceived difficulties.

## 9.5 Overview of Achievements

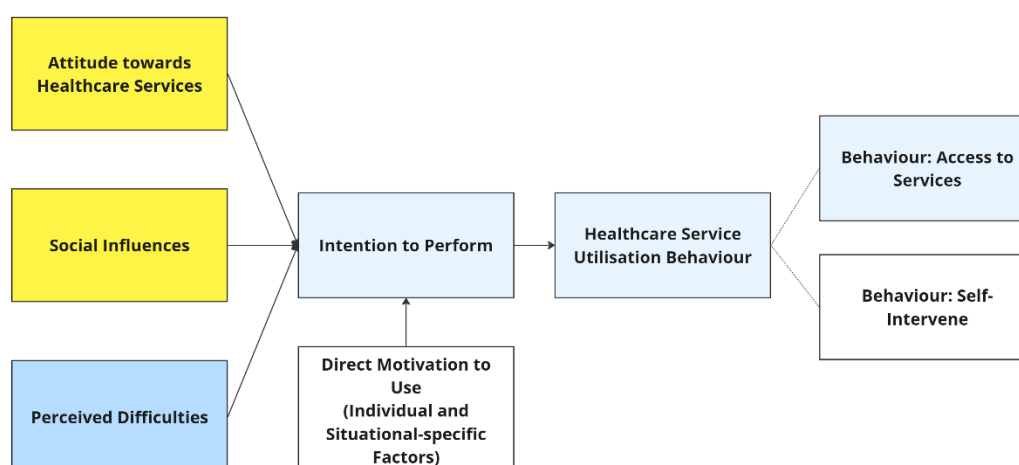


Figure 9.1 Overview of achievements of the thesis. The thesis investigated Chinese overseas students' decision-making behaviour to utilise healthcare services. This behaviour is explained using the Theory of Planned Behaviour framework. Yellow-coloured parts represent what we understand from students. The blue-coloured part represents what we addressed through the chatbot design. Some elements are coloured in pile colours, as our chatbot is only able to impose partial influences. To conclude, our chatbot design is effective in reducing students' perceived difficulties.

This section synthesises the key achievements of the thesis. Studies in Chapters 4, 5 and 6 confirmed Chinese overseas students' reluctance to utilise healthcare services. Our findings showed that this reluctance is prevalent across different types of illnesses, from physical to mental, from minor to emergency and chronic. They prefer to self-intervene over utilising healthcare services unless the condition is critical. This finding is illustrated by two elements located on the right-hand side in Figure 9.1.

Chapter 5 identified three key aspects that contribute to students' reluctance: their negative attitudes toward services, their perceived difficulties in using services, and

the external influence of other people and the influence of the social environment. This finding is illustrated by three elements located on the left-hand side in Figure 9.1. This finding matches key concepts across behavioural change theories. Apart from the TPB (Ajzen, 1991), which we used to build our framework, our determinants also coincide with other behavioural change theories such as the SCT (Bandura, 1986). Students' negative attitudes correspond to the concept of cognitive factors in SCT. Students feel dissatisfied with UK services because they are time and effort-consuming, and students believe that UK services cannot fulfil their expectations. Students' perceived difficulties correspond to the concept of self-efficacy in SCT and HBM (Rosenstock, 1974). Students feel unable to utilise UK services because they are expected to overcome many barriers that they have never dealt with. Student's behaviour is also influenced by how others think and behave, corresponding to the social influence in SCT. They exchange healthcare experiences with their colleagues, receive advice from their families and seek information online.

Chapter 7 documented the design and implementation of a chatbot prototype. Informed by the pain points in Chapter 6, I implemented the chatbot to provide introductory information that helps Chinese overseas students familiarise UK services and prepare for consultations. Chapter 8 evaluated the chatbot's effectiveness in addressing the reluctance problem. Results from the mixed-method WoZ experiment showed that our chatbot design is effective in reducing students' perceived difficulties of service utilisation (H2 in Chapter 8). However, the chatbot design did not improve students' perception of UK healthcare services, although it made them feel more capable of engaging with these services. (H3 in Chapter 8). This result showed that students are still not willing to utilise healthcare services in the UK subjectively (H1 in Chapter 8), but they become more confident in confronting challenges in accessing care services. Overall, the chatbot design partially changed Chinese students' reluctance to healthcare utilisation. This conclusion is reflected in blue-coloured elements in Figure 9.1.

## 9.6 Limitations of the Thesis

This section highlights the limitations associated with the three research questions in Chapter 1: starting from understanding Chinese overseas students (c.f. RQ1), to ideating the design (c.f. RQ2), and then implementing and evaluating the chatbot's effectiveness (c.f. RQ3).

**Understanding Chinese overseas students (c.f. RQ1):** Chapter 4 and Chapter 5 used self-reflection and qualitative interviews to understand Chinese overseas students' healthcare utilisation behaviour. While I iteratively conducted unstructured interviews and reached thematic saturation, I only recruited participants who studied in the Edinburgh region to speak about their healthcare management behaviour. This

limitation is also applied to Chapter 6, when I investigated Chinese students' experiences of interacting with healthcare services. Across those three studies, students reported their experiences with a particular health board, the NHS Lothian. Due to time and resource constraints, our results may be biased in terms of only investigating a specific branch of NHS. Some of the results may not be prevalent in other regions in the UK. For example, in Chapter 6 we mentioned the difficulty of GP registration and dealing with administrative matters; this may not be applicable to other regions as different health boards may have different situations and tackle things differently. For example, urban regions may have a more internationalised population with more health departments than rural regions. In addition, NHS England and HSC in Northern Ireland have some different policies with regard to access to prescribed medicines and specialists; our results may not reflect how those variants affect students' healthcare service utilisation behaviour. Although I think our qualitative results reflect the trend of opinions and behaviour among Chinese overseas students, future work may collect concrete data to complement our understanding.

Another limitation in understanding relates to the conceptual framework that we have built. In Chapters 4, 5 and 6, I conducted qualitative studies to develop an explanation of Chinese overseas students' health utilisation behaviour. We built this framework based on our interpretations of 20 Chinese students in total. This framework does not have any statistical implications and has not undergone factor analysis to control confounding variables. Future studies could refine our framework on a greater number of Chinese overseas students to draw quantitative implications.

**Ideating the design (c.f. RQ2):** Chapter 6 described the co-design process of gathering user requirements and pain points for chatbot development. Accessing healthcare services is a two-party interaction between the patient and healthcare providers (Levesque et al., 2013). However, due to resource limitations, we did not include any healthcare workers in the ideation phase. One consequence of this is that our results only reflect students' situations and needs and neglect the situations and needs of healthcare workers. Pain points such as dissatisfaction and feelings of not being valued may be biased towards students, and problems associated with NHS may not be understood adequately. For example, in our findings (Section 6.4.3.1), students complained about NHS being slow and ineffective, particularly when dealing with minor illnesses. However, this might be a “deliberate” design from doctors' and health administrators' perspectives, as they have to prioritise severe illnesses. The lack of healthcare workers' involvement limits the design possibilities of what can be addressed. Our ideation of the chatbot design is primarily based on students' viewpoints. Students proposed chatbot solutions without thinking of their viability on the healthcare providers' side. For example, some participants proposed to use the chatbot to give medical recommendations without recognising potential medical risks and ethical implications. Some participants proposed to use the chatbot as a patient



portal without recognising the complexity of integrating new technologies into existing systems. It would be best if we could also discuss students' pain points with healthcare administrators and think about solutions.

**Implementation and Evaluation (c.f. RQ3):** I did not use advanced machine-learning techniques to implement the educational chatbot. Dialogue contents are handwritten, and the dialogue management is pre-determined by a finite set of rules. This means that users can only interact with a fixed number of contents in pre-determined ways. For example, the ordering of the content confused some users, as the user had to finish one conversation branch to jump to another branch. In Chapter 8, participants reported that the chatbot interactions were repetitive (from SASSI), and some participants questioned its reusability in supporting healthcare utilisation (from interviews). Future work can investigate alternative dialogue system implementations, such as creating a knowledge base or utilising online queries to interact with users more intelligently.

In addition, because of the time constraint, we only managed to test the prototype with 3 people before the formal evaluation. As a result, the chatbot prototype had some usability issues. In Chapter 8, one problem that students found particularly confusing was the implementation of the return feature; they expected to return one level up of the current branch instead of going one turn back of the conversation. Another popular problem is related to the speed of message pop-ups. Some students felt that the chatbot popped messages too quickly to read properly. These usability problems would be alleviated if we had more time for testing and making adjustments.

The mixed-method WoZ evaluation described in Chapter 8 was conducted with only 20 participants. While results can be used to demonstrate the potential usefulness of our chatbot design, it does not necessarily illustrate its effectiveness against the entire Chinese overseas student population. Future research can deploy our chatbot design with a larger population and look at the persistence of attitude changes. Once that is established, a randomised controlled trial can be envisaged.

Another limitation relates to evaluation in experimental settings. While it is easier to set up and collect comparative data, the experiment only lasts for a short period of time. In our experiments, students only interacted with the chatbot for 20 minutes in total. This means we only evaluated the short-term effectiveness of the chatbot design. We demonstrated that students felt more capable of utilising healthcare services immediately after the interaction, but their thoughts may have changed over time. Future research may consider conducting longitudinal studies to better understand the chatbot's effectiveness over a longer period of time.

## 9.7 Landscape of Supporting Healthcare Service Utilisations

Recognising that immigrants struggle to utilise healthcare services, various measures have been taken into action to support immigrants' use of healthcare services. In the UK, NHS distributes dedicated flyers to explain how the treatment process works to immigrants (*NHS England*, 2023) and provides free interpreter services for those who struggle with English problems (*Language Interpreting and Translation*, 2021). In the literature, researchers investigated ways immigrants utilise healthcare services and put forth policy recommendations according to their needs.

One problem is that immigrants tend to underutilise primary care services. The primary reason for this is due to the language problem (C. X. Zhang et al., 2022). While NHS does provide language services, however, human translators are not always available in practice. To address this, researchers suggested encouraging the use of online translation tools in GP consultations (Al Shamsi et al., 2020). (Problem 1)

Apart from language, research also showed that immigrants and healthcare workers often misunderstand and misinterpret each other, resulting in conflicts and dissatisfaction (Akhavan, 2012; Henderson & Kendall, 2011; Småland Goth & Berg, 2011). To address this issue, research suggested that providing essential training to healthcare professionals to raise their cultural awareness and enhance their communication skills with patients (Majumdar et al., 2004; Memon et al., 2016; McGregor et al., 2019). (Problem 2)

Immigrants tend to overuse emergency services to substitute primary care services. The reason behind this phenomenon is that they commonly do not have sufficient health literacy to distinguish different services (Norredam et al., 2004; Cots et al., 2007). De Luca et al. (2013) suggested that simplifying organisational procedures and establishing channels between healthcare providers and immigrants would help to guide immigrants in identifying the right service. (Problem 3)

While research proposed different policies to address the needs of immigrants, little is known about how effective these policies will be (Mladovsky et al., 2012). Implementing these policies requires time, resources, and money. The effectiveness of those policies may vary between subgroups of the immigrant population, and the quality of implementation may vary due to the involvement of multiple stakeholders.

Our chatbot prototype is capable of making students more capable of using healthcare services. To deal with language and communication problems, traditional policy interventions suggested making translation services more available, with skilled interpreters and trained healthcare workers (P. S. Gill et al., 2011; McGregor et al., 2019). A chatbot implementation would be a great complement because: 1. It is always available, 2. It trains the user to speak by themselves. (c.f. Problem 1)

In addition, I argue that it is also important to make students know what is expected from them to utilise healthcare services and make them aware of the cultural differences in treatments. This is reflected in the chatbot design, where it introduces information to help students manage expectations and plan their arguments. After interacting with the chatbot, students can better represent themselves to negotiate with healthcare professionals instead of relying on interpreters. (c.f. Problem 2)

To address the problem of overutilisation of emergency services and underutilisation of primary care services, traditional policy interventions suggested simplifying organisation procedures and establishing communication channels between healthcare providers and patients to guide patients on what services to use (De Luca et al., 2013). I argue that it is also important to make students aware of different services prior to the illness. This is reflected in the chatbot design, which gives an overview of the UK healthcare system and explains different services within the system to help students know which services to visit when they are ill. (c.f. Problem 3)

## 9.8 Future Directions to Improve the Chatbot and Support Healthcare Service Utilisation

The findings in this thesis displayed new opportunities for future research to advance the use of dialogue systems as well as showing novel paths to support healthcare utilisation.

**Chatbot design for changing attitudes:** Our chatbot design provides introductory information which focuses on helping Chinese overseas students to become familiar with UK healthcare services and prepare for consultations. While evaluation results showed its effectiveness in reducing perceived difficulties and increasing their confidence in utilisation, the chatbot design did not change students' negative attitudes towards UK services. As shown in the answer to H3 (see Chapter 8), students still prefer to manage health problems by themselves. This shows that providing introductory information may not be enough to encourage students to fully utilise healthcare services. Future work should look into ways to change students' subjective feelings towards UK healthcare services.

Since dialogue systems exhibit unique characteristics to interact with humans, one possibility is to use dialogue systems to persuade Chinese students to change their ideas. One possible design is to use conversations to trigger critical reflections (Kocielnik et al., 2018; Kocielnik, 2021). For example, using chatbots with daily check-ins and monitoring to document students' health conditions and chat with them about what they did to seek help.

**More intelligent chatbot implementation:** Due to time and resource constraints, I used handwritten scripts and pre-determined flows to control the conversation. While this approach is easy to implement and gives humans full control of the conversation flow, it affects the flexibility of the conversation. In the WoZ experiment, students were only allowed to ask a fixed set of questions. Although I used WoZ to mitigate this issue, this is still far from natural human conversations (Students can ask open questions at the end of the conversation. See Appendix E6 about what questions they have asked). To address this issue, future research may consider using advanced natural language processing techniques such as end-to-end deep learning (Vaswani et al., 2017), and reinforcement learning (Ouyang et al., 2022) to implement the chatbot. However, the realisation of those chatbots, like ChatGPT (OpenAI, 2023) needs careful attention to their answers. They tend to give inaccurate answers with misinformation, posing risks of misleading users to make wrong decisions.

**Explore the external validity of the chatbot design:** Although our studies focused exclusively on Chinese overseas students, we are aware that our chatbot design may apply to other contexts, such as non-Chinese international students. They may also face similar barriers in utilising healthcare services. For example, language and communication issues, as they are not native English speakers, and service familiarisation issues, as they have different healthcare systems in their home countries found in other studies (O'Rourke, 2020). Since our chatbot design provides introductory information about UK services and helps users prepare for consultations, it may be useful to help other international students as well. Future research could apply our chatbot design to other immigrant groups in the UK to investigate its effectiveness in changing their healthcare utilisation behaviours.

**Support beyond using chatbots:** In Chapter 5, we formulated Chinese overseas students' healthcare utilisation behaviour using the Theory of Planned Behaviour framework. While "Perceived difficulties" and "Attitudes towards healthcare services" can be changed by chatbot conversations, it is hard to use a chatbot to impose "Social influence" on students. However, social influence is an important determinant when students make healthcare decisions. For example, findings in Chapters 5 and 6 showed that students share medical experiences to learn to overcome obstacles and form opinions towards healthcare services. Future research could investigate the social dynamics of the Chinese overseas students' community (including online social platforms such as XiaoHongShu), For example, how students interact with each other, how they interact with teaching staff, and how they use university services, and then use service design techniques to create a supportive environment to promote healthcare utilisation.

## 9.9 Conclusion

In recent years, Chinese students have consistently constituted the largest demographic of international students in the UK. Like other immigrant populations, they are reluctant to seek professional help and underutilise different kinds of healthcare services, posing threats to their health and well-being. Chinese overseas students face common obstacles such as language barriers, unfamiliarity with the healthcare system, and cultural differences in healthcare practices, as well as unique problems such as acculturation stress and lack of social support. In addition to obstacles, it is prevalent that Chinese overseas students hold negative attitudes towards UK healthcare services, believing that accessing healthcare services can be time and effort-consuming with limited returns.

In this thesis, I followed the HCD approach to understand, ideate, develop and evaluate a chatbot that educates Chinese overseas students to become familiar with UK healthcare services and prepare for consultations, aiming to encourage them to utilise healthcare services in the UK. I reflected on my personal experiences and used the grounded theory approach to interview Chinese overseas students about their health and well-being management behaviour, with a particular focus on their decisions in accessing healthcare services. In this process, I found three key determinants for Chinese students' healthcare utilisation: the "Perceived difficulties to use", the "Attitude towards UK healthcare services", and the "Social influences". Next, I hosted co-design workshops to collect detailed pain points and users' wants in Chinese students' healthcare utilisation journeys. I found that the unfamiliarity with UK services and the insufficient communication skills are the two possible design opportunities to be addressed by chatbots. Based on this result, I prototyped the chatbot and evaluated its effectiveness in promoting Chinese overseas students' willingness to utilise UK services. The results from the mixed-method WoZ experiment demonstrated the potential to use our chatbot design to reduce Chinese students' perceived difficulties and boost their confidence to utilise UK healthcare services.

My work is one of the first research projects that looks into the use of dialogue systems in supporting Chinese overseas students to use healthcare services. This work complements existing policies and practices, such as cultural awareness education programmes and interpreter services on the health provider's side. Instead of making services more accessible, my chatbot design addresses problems on the patient's side, helping Chinese overseas students to become familiar with the UK healthcare system and prepare for consultations. This empowers Chinese overseas students' perceived ability to access healthcare services. Considering the large cohort of international students in UK universities, our chatbot design may also be beneficial to wider audiences, supporting them to better utilise healthcare services in the UK.

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## Appendices

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## **Appendix A: Sponsor Letter, Recruitment Letter, Participant Information Sheets, and Consent Forms**

In this thesis, there are three studies involving human participants and their experiences with healthcare (the Grounded theory study, the Co-design workshop study, and the WoZ experiment study). Appendix A1 documented the sponsor letter, which was approved by the ACCORD, the representative of the University of Edinburgh, to sponsor this research project.

This appendix also documents the recruitment letter, participant information sheets and consent forms respective to each study (A2 to A4 for the grounded theory study; A5 to A7 for the Co-design workshop study; A8 to A10 for the Wizard of OZ study). We used these documents to inform participants about what was involved in the studies and how we collected data. All documents were reviewed and approved either by the School of Psychology Ethics Committee at the University of Edinburgh (reference: 273-1819/2) (the grounded theory study) or by the Ethical Committee in the School of Informatics, University of Edinburgh (reference: 2021/49786) (the co-design workshop study and the Wizard of Oz study).

## A1: ACCORD Sponsor Letter

THE UNIVERSITY *of* EDINBURGH

**Research Governance**  
The University of Edinburgh  
Queen's Medical Research Institute  
47 Little France Crescent  
Edinburgh EH16 4TJ  
United Kingdom

**Tel** +44 (0) 131 242 9100

resgov@accord.scot

3<sup>rd</sup> April 2019

Dear Maria Wolters

**"Improving the healthcare experience: Bridging the communication gap between doctors and Chinese students"**

Under the requirements of the UK Policy Framework for Health and Social Care Research, the University of Edinburgh agrees in principle to act as Sponsor for this project. Sponsorship is subject to Sponsor review and approval of study documentation and to you obtaining all relevant approvals.

As Chief Investigator, you must ensure that the study does not commence until all applicable approvals have been obtained. Following receipt of all relevant approvals, you should ensure that any substantial amendments are reviewed and authorised by the Sponsor prior to submission for applicable approvals.

Yours sincerely,

Chris Coner

Research Governance Coordinator  
Research Governance  
University of Edinburgh  
The Queen's Medical Research Institute  
47 Little France Crescent  
Edinburgh, EH16 4TJ

## A2: Grounded Theory Study Recruitment Letter

design  
informatics



THE UNIVERSITY  
of EDINBURGH

# Chinese students: How do you talk to UK Doctors?

## Earn £10 Amazon voucher



For my PhD project, I would like to talk to Chinese international students about the ways in which they talk about their health to doctors, pharmacists, and other health professionals.

The interview will involve relaxed conversation for approximately 1 hour. It will be fully anonymous.

UG, Masters, PhD students are all welcome!

In the interview we might talk about:

1. How did you talk about your health problems to doctors, pharmacists, nurses in English?
2. How did you access the health care services?
3. What was your experience like?
4. How do you explain Chinese health and well-being concepts to non-Chinese people?

- The interview will be conducted in Mandarin
- Appointments can be made according to your availability

All data is collected and stored in accordance with the GDPR  
Ethics approved by the School of Philosophy, Psychology and Language Sciences Research Ethics Committee

Application No. 273-1819/2

If you are interested,  
please contact:

Liquan Chai  
Email:  
liquan.chai@ed.ac.uk  
or via Wechat (QR code)



## A3: Grounded Theory Participant Information Sheet

### How do you use the NHS? An Interview Study

---

#### What is this study about?

This interview study is a part of Liquan Chai's PhD project in the centre of Design Informatics, at the University of Edinburgh. The aim of the PhD project is to develop tools that Chinese students can use to learn language and communication skills which will make it easier for them to talk to doctors, nurses and other health care professionals in the UK. We invite you to this interview because you are one of these Chinese students who are studying in the UK. From this interview, we want to identify the kinds of language and communication support that Chinese students need. We will ask you to describe some of your past experiences with going to see a doctor in the UK. Since this is a very sensitive topic, we will only talk about health problems and experiences that you feel comfortable to talk about.

#### Who is conducting this research?

The interview will be conducted by Liquan Chai ([liquan.chai@ed.ac.uk](mailto:liquan.chai@ed.ac.uk)) as a part of his PhD research project at the University of Edinburgh. This project is supervised by Dr Maria Wolters ([maria.wolters@ed.ac.uk](mailto:maria.wolters@ed.ac.uk)) and Dr Dave Murray-Rust ([d.murray-rust@ed.ac.uk](mailto:d.murray-rust@ed.ac.uk)) at the centre of Design Informatics, the University of Edinburgh.

#### What will happen during the interview?

The interview will take place in a quiet, private room, with only you and the interviewer present. To ensure that you will be as comfortable as possible, the interviewer will ask you to let him know whether there are any topics that you do not wish to discuss. During the interview, we will talk about some of your experiences with seeing a doctor, nurse, pharmacist, or other health care professionals while in the UK, specifically while in Scotland. Topics may include how you felt before, during, and after seeing a health care professional, what you already know about medicine and staying healthy, and how you would normally access medical care in China.

We will only talk about experiences with the health care system that you wish to share with the interviewer.

#### How long it will take?

The interview is expected to take one hour.

### How we collect and use your data?

We highly value your privacy. We have various measures to ensure your data is collected and is being kept confidentially during and after the project.

Before the interview, you will be asked whether you consent to the interview being audio taped. You may ask the interviewer to take hand-written notes instead of recording for some parts of the interview or the entire interview. While we will not use any of your personal information (e.g. name, address, email, etc.) to carryout analysis, we will ask you for some basic demographic information (gender, age group) for participant categorisation. After the interview, the raw file will be processed through the audio editing software to ensure that any direct information (e.g. name, address, email) and indirect information (e.g. the school and the university you studied in, the GP you have registered) that potentially make you identifiable will be erased and not recoverable. The raw audio will be destroyed once the editing process is complete. Then, the anonymised audio will be transcribed to facilitate further analysis. Hand-written notes will also be digitised, and direct and indirect information that may make you indefinable will be erased and not recoverable. The original, paper-based notes will be destroyed. All the anonymisation and transcription work will be conducted by Liquan Chai. All interview contents, (i.e. audio, notes, raw and anonymised) will be stored in password protected drives which placed in UK.

The anonymised interview content (i.e. anonymised audio, transcripts, anonymised notes) will be kept for long-term use and will be analysed by Liquan Chai in collaboration with his supervisors. The results (e.g. quotes, statements, findings) of the project may be disseminated in talks or scientific papers and will be written up as part of Liquan Chai's PhD thesis.

If you signed the consent form, the consent form will also be digitised, and the original, paper-based form will be destroyed. The digitised consent form will be fully encrypted, and will be stored in a password protected, GDPR compliant, cloud drive in UK which separate from the content of the interviews. The form will be kept at least three years of the completion of the PhD project, and it will only be accessed by Liquan Chai, his supervisors and the Psychology research ethics committee.

For more information about how we manage your data and how it fits GDPR, please visit:

<https://edin.ac/privacy-research>

### What are your rights?

Before the interview, the interviewer will ensure that you have had the opportunity to read this information sheet and ask any questions that you may have.



If you do choose to participate in the interview, your participation will be confidential. For details about how we protect your data, please see the "How we collect and use your data" section.

During the interview, you may decide what topics to cover or not to cover. You have the right to refuse to answer or respond to any question without explanation. You also have the right to choose whether the interview may be audio recorded or not. You can withdraw your consent at any time, even during the interview, and you have the right to ask that any data you have supplied to that point be destroyed.

After the interview, you can ask the interviewer to send you a copy of the raw and the anonymised data (i.e. audio, transcription and/or hand-written notes).

#### **What are the benefits and risks?**

This study is voluntary. There are no direct benefits for you. However, the interview may involve some discussions about personally and/or culturally sensitive topics, and you may find it uncomfortable to recall some of your experiences. You can skip topics and refuse to answer questions at any time, without giving reasons.

#### **What are the incentives to participate in this study?**

You will be compensated for your time with a £10 Amazon voucher.

#### **Further questions?**

If you have any question about this interview or this research project, please do not hesitate to contact Liquan by email ([liquan.chai@ed.ac.uk](mailto:liquan.chai@ed.ac.uk)) or by phone (07598463178).

If you prefer to contact an alternative person, you can also contact Dr Maria Wolters ([maria.wolters@ed.ac.uk](mailto:maria.wolters@ed.ac.uk)) and Dr Dave Murray-Rust ([d.murray-rust@ed.ac.uk](mailto:d.murray-rust@ed.ac.uk)).

If you have questions about your rights in this research, or you have any other questions, concerns, suggestions, or complaints that you do not feel can be addressed by the researcher, please contact the Convener of the School of Philosophy, Psychology & Language Sciences (PPLS) Psychology Research Ethics committee ([psych.ethics@ed.ac.uk](mailto:psych.ethics@ed.ac.uk)).

Ethical approval number: 273-1819/2

## A4: Grounded Theory Participation Consent Form

**How do you use the NHS? An Interview Study**

|                                         |             |
|-----------------------------------------|-------------|
| Research investigator(s)                | LIQUAN CHAI |
| Participant information sheet version   | PIS-Mar5    |
| Ethical Approval Number                 | 273-1819/2  |
| Participant Identification Number (PIN) |             |

By signing the form, I agree that:

Please tick the appropriate boxes

**Participation:**

1. I confirm that I have read the participant information sheet for the above study. I have been able to ask questions about the study and my questions have been answered to my satisfaction. ☐
2. I understand that my participation is voluntary and that I am free to withdraw at any time, even during the interview. ☐

**Data collection and use:**

3. I understand that the interview will be audio-recorded. However, I may ask the interviewer to use hand-written notes instead for some parts or the entire interview. ☐
4. I understand that my response will be anonymised by Liquan Chai. The anonymised data will be analysed by Liquan Chai and his supervisors. The anonymised data might be disseminated in academic communities and be written up as part of Liquan Chai's PhD thesis. ☐

**About this project:**

5. I notice that the interview may potentially involve questions that makes me uncomfortable. However, I can refuse to answer these questions, without giving reasons. ☐

**Contact details:**

6. I understand that this consent form asks me about my contact information. My contact information might be used by Liquan Chai to contact me about this study and my interest in follow up studies. My contact information will be stored separately from the research data and only be accessible by Liquan Chai, his supervisors and the Psychology research ethics committee. ☐

**General:**

7. I agree to take part in the above study. ☐



\_\_\_\_\_  
Name of Participant  
[IN CAPITALS]

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Name of Researcher  
[IN CAPITALS]

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

**Contact information**

The participant

Email/Wechat:

The researchers

|                    |                                                                    |
|--------------------|--------------------------------------------------------------------|
| Liquan Chai        | <a href="mailto:liquan.chai@ed.ac.uk">liquan.chai@ed.ac.uk</a>     |
| Dr Maria Wolters   | <a href="mailto:maria.wolters@ed.ac.uk">maria.wolters@ed.ac.uk</a> |
| Dr Dave Murry-Rust | <a href="mailto:d.murray-rust@ed.ac.uk">d.murray-rust@ed.ac.uk</a> |

## A5: Co-design Workshop Study Recruitment Letter

design  
informatics



# Navigating the NHS as a Chinese Student

A workshop study about your UK  
health care experiences

Earn £10 Amazon voucher



We are running 1-to-1 workshops to investigate health care experiences that Chinese overseas students have during their study in the UK, so that we can design a chatbot to help students understand how the NHS works.

What we are looking for:

- 1) You are studying, or have studied, in a university in the UK (Undergraduate, Masters, PhD)
- 2) You have an experience that you would like to share with us
- 3) The passion to co-design ways to improve the situation

The workshop is about 60min. In the workshop, you will talk through the journey of your experience, identify problems, and reflect and ideate what can be helpful in the form of a chatbot. All data will be anonymised to ensure that it will be impossible to identify you from any quotes.

Appointments can be made according to your availability.

If you are interested, please contact:

Liquan Chai: [liquan.chai@ed.ac.uk](mailto:liquan.chai@ed.ac.uk) or via Wechat (QR code)

Informatic Ethics Ref No. 2021/49786



## A6: Co-design Workshop Study Participant Information Sheet

### Chatbots for Better Health Care Accessibility: A Co-design Workshop

#### Study on Chinese Overseas students

---

##### What is this study about?

This 1-to-1 interview/co-design workshop study is a part of Liquan Chai's PhD project in the centre of Design Informatics, at the University of Edinburgh. The PhD project aims to understand Chinese overseas students manage discomforts in the UK environment and develop tools to support them to make sense of UK health practices so that they can better interact with the UK health care services.

We invite you to this study because you are one of these Chinese students who are currently studying or have studied in the UK, and you have at least one health care management experience that you are willing to share with us. In this workshop study, we would like to record a journey that you managed discomforts. After that, we will have a reflective and ideation activity for you to imagine a chatbot to address problems that you had in your discomfort management journey.

Since talking about health care experiences is a very sensitive topic, we will only talk about experiences that you feel comfortable sharing with us. If you feel uncomfortable, you may cease and withdraw from the study at any time.

##### Who is conducting this research?

The workshop study will be conducted by Liquan Chai ([liquan.chai@ed.ac.uk](mailto:liquan.chai@ed.ac.uk)) as a part of his PhD research project at the University of Edinburgh. This project is supervised by Dr Maria Wolters ([maria.wolters@ed.ac.uk](mailto:maria.wolters@ed.ac.uk)) at the centre of Design Informatics, the University of Edinburgh and Dr Dave Murray-Rust ([d.s.murray-rust@tudelft.nl](mailto:d.s.murray-rust@tudelft.nl)) at the University of Delft.

##### What will happen during the workshop?

The study will take place in a quiet, private room, with only you and the interviewer present. Before the workshop, we will ask you whether there are any topics that you do not wish to discuss and inform about your rights to cease the study.

At the start of the workshop, we will talk through one of your health care management experiences that you wish to talk about. This includes 3 stages: before seeking help, during consultation or self-intervention, and after seeking help or self-intervention. Then, we will ask a set of reflective questions such as difficulties in the journey and their causes. Examples will be given as cards to stimulate the journey-talking and reflection activity. At the end of the

workshop, you will be invited to create a scenario leveraging a chatbot to address these difficulties and then test the interaction with a sample Wizard-of-Oz task.

### **How long it will take?**

The study is approximately 60 minutes.

### **How do we collect and use your data?**

Your interaction with the interviewer will be audio-recorded. Your health care management journey will be captured by a paper-based journey map, which will later be analysed by the research team.

We have various measures to keep your data confidential during and after the project. The raw audio-recording will be processed through the editing software to ensure that any direct information (e.g., name, address, email) and indirect information (e.g., the school and the university you studied in, the GP you have registered) that potentially make you identifiable will be erased and not recoverable. The raw audio recording will be destroyed once the editing process is complete. The anonymised audio will be transcribed as pseudonymised scripts to facilitate further analysis. Hand-written such as memos and experience journey maps will also be digitised, and direct and indirect information that may make you indefinable will be erased and not recoverable. All workshop contents, (i.e. audio recordings, memos, journey maps, raw and anonymised) will be stored in encrypted, password-protected drives placed in the UK.

The anonymised workshop content (i.e., audio recordings, journey maps) will be kept for long-term use and will be analysed by Liquan Chai in collaboration with his research team. The results (e.g., quotes, statements, findings) of the project may be disseminated in talks or scientific papers and will be written up as part of Liquan Chai's PhD thesis.

If you sign the consent form, the consent form will also be digitised, and the original, paper-based form will be destroyed. The digitised consent form will be fully encrypted, and will be stored in a password protected, GDPR compliant, cloud drive in the UK which separates from the workshop contents. The form will be kept at least three years of the completion of the PhD project, and it will only be accessed by Liquan Chai, his supervisors and the Informatics research ethics committee.

For more information about how we manage your data and how it fits GDPR, please visit:

<https://edin.ac/privacy-research>

**What are your rights?**

Before the workshop, we will ensure that you have had the opportunity to read this information sheet and ask any questions that you may have.

If you do choose to participate in the workshop, your data will be kept confidential. For details about how we protect your data, please refer to the “How we collect and use your data” section.

During the workshop, you may decide what to cover or not to cover. You have the right to refuse to answer any question without explanation. You can withdraw your consent at any time, even during the workshop, and you have the right to ask that any data you have supplied to that point be destroyed.

After the workshop, you can ask the interviewer to send you a copy of the raw and the anonymised data (i.e., audio, transcription and/or hand-written notes).

**What are the benefits and risks?**

This study is voluntary. There are no direct benefits for you. However, the workshop may involve sensitive topics, and you may find it uncomfortable to recall some of your experiences. You can skip topics and refuse to answer questions at any time, without giving reasons. You will be compensated for your time with a £10 Amazon voucher.

**Further questions?**

If you have any questions about this workshop or this research project, please do not hesitate to contact Liquan by email ([liquan.chai@ed.ac.uk](mailto:liquan.chai@ed.ac.uk)).

If you prefer to contact an alternative person, you may contact Dr Maria Wolters ([maria.wolters@ed.ac.uk](mailto:maria.wolters@ed.ac.uk)) and Dr Dave Murray-Rust ([d.s.murray-rust@tudelft.nl](mailto:d.s.murray-rust@tudelft.nl)).

If you have questions about your rights in this research, or you have any other questions, concerns, suggestions, or complaints that you do not feel can be addressed by the researcher, please contact the Convener of the School of Informatics Research Ethics committee ([inf-ethics@inf.ed.ac.uk](mailto:inf-ethics@inf.ed.ac.uk)).

Informatics ethics reference number: 2021/49786

## A7: Co-design Workshop Consent Form

**Chatbots for Better Health Care Accessibility: A Co-design Workshop****Study on Chinese Oversea students**

|                                         |             |
|-----------------------------------------|-------------|
| Research investigator(s)                | LIQUAN CHAI |
| Participant information sheet version   | PIS-Nov-21  |
| Ethics Reference Number                 | 2021/49786  |
| Participant Identification Number (PIN) |             |

By signing the form, I agree that:

Please tick the appropriate boxes

**Participation:**

1. I confirm that I have read the participant information sheet for the above study. I have been able to ask questions about the study and my questions have been answered to my satisfaction. ☐
2. I understand that my participation is voluntary and that I am free to withdraw at any time, even during the interview. ☐

**Data collection and use:**

3. I understand that the interview will be audio-recorded. However, I may ask the interviewer to use hand-written notes instead for some parts or the entire interview. ☐
4. I understand that my response will be anonymised by Liquan Chai. The anonymised data will be analysed by Liquan Chai and his supervisors. The anonymised data might be disseminated in academic communities and be written up as part of Liquan Chai's PhD thesis. ☐

**About this project:**

5. I notice that the interview may potentially involve questions that makes me uncomfortable. However, I can refuse to answer these questions, without giving reasons. ☐

**Contact details:**

6. I understand that this consent form asks me about my contact information. My contact information might be used by Liquan Chai to contact me about this study and my interest in follow up studies. My contact information will be stored separately from the research data and only be accessible by Liquan Chai, his supervisors and the Psychology research ethics committee. ☐

**General:**

7. I agree to take part in the above study. ☐





|                     |           |       |
|---------------------|-----------|-------|
| _____               | _____     | _____ |
| Name of Participant | Signature | Date  |
| [IN CAPITALS]       |           |       |

|                    |           |       |
|--------------------|-----------|-------|
| _____              | _____     | _____ |
| Name of Researcher | Signature | Date  |
| [IN CAPITALS]      |           |       |

**Contact information**

The participant

Email/Wechat:

The researchers

|                    |                                                                    |
|--------------------|--------------------------------------------------------------------|
| Liquan Chai        | <a href="mailto:liquan.chai@ed.ac.uk">liquan.chai@ed.ac.uk</a>     |
| Dr Maria Wolters   | <a href="mailto:maria.wolters@ed.ac.uk">maria.wolters@ed.ac.uk</a> |
| Dr Dave Murry-Rust | <a href="mailto:d.murray-rust@ed.ac.uk">d.murray-rust@ed.ac.uk</a> |

## A8: WoZ Experiment Recruitment Letter

design  
informaticsTHE UNIVERSITY  
of EDINBURGH

# What should I know before seeing a doctor in the UK?

A chatbot experiment for Chinese overseas  
students



Earn a £10 Amazon voucher

We are running an experiment to evaluate a chatbot system that introduces Chinese overseas students to the UK health care system. We are interested in your attitude and intention to use the UK health care system.

## What we are looking for:

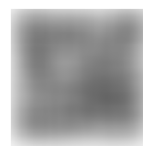
- (1) A Chinese student who comes to the UK no more than 3 months.
- (2) Have no, or very limited experience with the UK health care system (e.g., have just registered with a GP, but never use it).
- (3) You are comfortable reading English texts.

## The experiment is about 60 minutes. In the experiment, you will:

- (1) Fill out some questionnaires about the UK health care and the chatbot
- (2) Talk to a chatbot several times
- (3) Be interviewed about your experience with the chatbot

## Please click or scan the QR code to register:

Enter your name and email. We will contact you to confirm the place & time.



## Have questions?

Please contact Liquan Chai (liquan.chai@ed.ac.uk)

The study is approved by the Informatics Ethics committee, University of Edinburgh, RT number 2021/49786

## A9: WoZ Experiment Participant Information Sheet

Page 1 of 4

### Participant Information Sheet

|                             |                                                                                                              |
|-----------------------------|--------------------------------------------------------------------------------------------------------------|
| Project title:              | What should I know before going to a doctor in the UK?<br>A chatbot experiment for Chinese overseas students |
| Principal investigator:     | Maria Wolters                                                                                                |
| Researcher collecting data: | Liquan Chai, Xinyi Cao, Yuhan Ma                                                                             |
| Funder (if applicable):     | N/A                                                                                                          |

This study was certified according to the Informatics Research Ethics Process, RT number 1149058. Please take time to read the following information carefully. You should keep this page for your records.

#### Who are the researchers?

The experiment will be conducted by Xinyi Cao, Yuhan Ma and Liquan Chai (liquan.chai@ed.ac.uk). This project is supervised by Dr Maria Wolters (maria.wolters@ed.ac.uk) at the Institute of Design Informatics, the University of Edinburgh and Dr Dave Murray-Rust (d.s.murray-rust@tudelft.nl) at the Delft University of Technology.

#### What is the purpose of the study?

This experiment is a part of Liquan Chai's PhD project in the centre of Design Informatics, at the University of Edinburgh. The project aims to develop tools to support Chinese overseas students to make sense of the UK health care system and make it easier for them to access appropriate services when they are ill.

In this experiment, we would like to test a chatbot system which aims to assist you to understand how the UK healthcare system works. We would also like to know whether the system affects your intention to use the UK health care system if you are feeling ill.



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**Why have I been asked to take part?**

We invite you to this experiment because you are a Chinese student who come to the UK within the last three months and who has limited experience with health care in the UK.

**Do I have to take part?**

No – participation in this study is entirely up to you. You can withdraw from the study at any time, up until 1 month after your participation, without giving a reason. After this point, your personal data will be deleted, and anonymised data will be combined such that it is impossible to remove individual information from the analysis. Your rights will not be affected. If you wish to withdraw, contact the PI. We will keep copies of your original consent, and your withdrawal request.

**What will happen if I decide to take part?**

You will be asked to complete the following 7 steps:

1. Fill out a questionnaire about your attitude towards and intention to use UK health care services.
2. Interact with a chatbot to learn more about the UK health care system. You can choose between two scenarios: (1) registering with a GP in the UK and (2) obtaining medication.
3. Tell us what you think about your interaction with the chatbot in a questionnaire.
4. Interact with a chatbot to learn more about the UK health care system. You can choose between two scenarios: (1) Managing minor health issues and (2) Handling emergencies)
5. Tell us what you think about your interaction with the chatbot in a questionnaire.
6. Tell us what you think about UK health care services after your interactions with the chatbot in a questionnaire
7. In a final interview, we will talk some more about your experiences with the chatbot and the UK health care system and debrief you about the study.

All interactions with the chatbot will be logged. This includes your input and the chatbot responses. Interviews will be audio recorded, and the recordings will be transcribed and anonymised after the study. We will not collect any of your personal information and will delete any data that make you identifiable before the analysis. You can also

stop the study at any time if you feel uncomfortable interacting with the chatbot. The experiment will be around 60 minutes to complete.

**Compensation**

You will be compensated with a £10 Amazon voucher.

**Are there any risks associated with taking part?**

During the study, you will be thinking about sensitive topics such as health problems, ways to access services, ways to interact with doctors, purchase of medicine, and ways to manage emergencies. This can be uncomfortable. At the end of the debriefing interview, we will suggest activities to relax and unwind.

**Are there any benefits associated with taking part?**

No.

**What will happen to the results of this study?**

The results of this study may be summarised in published articles, reports and presentations. Quotes or key findings will be anonymized: We will remove any information that could, in our assessment, allow anyone to identify you. With your consent, information can also be used for future research. Your data may be archived for a maximum of 6 years. All potentially identifiable data will be deleted within this timeframe if it has not already been deleted as part of anonymization.

**Data protection and confidentiality.**

Your data will be processed in accordance with Data Protection Law. All information collected about you will be kept strictly confidential. Your data will be referred to by a unique participant number rather than by name. Your data will only be viewed by the research team, Liquan Chai, Maria Wolters, and Dave Murray-Rust.

All electronic data will be stored on a password-protected encrypted computer, on the School of Informatics' secure file servers, or on the University's secure encrypted

cloud storage services (DataShare, ownCloud, or Sharepoint) and all paper records will be stored in a locked filing cabinet in the PI's office. Data may be shown to Dave Murray-Rust via screen share during video calls, and he may view the data when he is in Edinburgh. Your consent information will be kept separately from your responses in order to minimise risk.

**What is my data protection rights?**

The University of Edinburgh is a Data Controller for the information you provide. You have the right to access information held about you. Your right of access can be exercised in accordance Data Protection Law. You also have other rights including rights of correction, erasure and objection. You will not be able to withdraw from the study after one month, since this would affect the integrity of the data. For more details, including the right to lodge a complaint with the Information Commissioner's Office, please visit [www.ico.org.uk](http://www.ico.org.uk). Questions, comments and requests about your personal data can also be sent to the University Data Protection Officer at [dpo@ed.ac.uk](mailto:dpo@ed.ac.uk).

**Who can I contact?**

If you have any further questions about the study, please contact the lead researcher, Liquan Chai, [liquan.chai@ed.ac.uk](mailto:liquan.chai@ed.ac.uk).

If you wish to make a complaint about the study, please contact [inf-ethics@inf.ed.ac.uk](mailto:inf-ethics@inf.ed.ac.uk). When you contact us, please provide the study title and details of the nature of your complaint.

**Updated information.**

If the research project changes in any way, an updated Participant Information Sheet will be made available on <http://web.inf.ed.ac.uk/infweb/research/study-updates>

**Alternative formats.**

To request this document in an alternative format, such as large print or on coloured paper, please contact Liquan Chai ([liquan.chai@ed.ac.uk](mailto:liquan.chai@ed.ac.uk)).

**General information.**

For general information about how we use your data, go to: [edin.ac/privacy-research](http://edin.ac/privacy-research)

## A10: WoZ Experiment Participation Consent Form

Participant number: \_\_\_\_\_

**Participant Consent Form**

|                              |                                                                                                           |
|------------------------------|-----------------------------------------------------------------------------------------------------------|
| Project title:               | What should I know before going to a doctor in the UK? A chatbot experiment for Chinese overseas students |
| Principal investigator (PI): | Maria Wolters                                                                                             |
| Researcher:                  | Liquan Chai, Dave Murry-rust, Maria Wolters                                                               |
| PI contact details:          | maria.wolters@ed.ac.uk                                                                                    |

By participating in the study you agree that:

- I have read and understood the Participant Information Sheet for the above study, that I have had the opportunity to ask questions, and that any questions I had were answered to my satisfaction.
- My participation is voluntary, and that I can withdraw at any time without giving a reason. Withdrawing will not affect any of my rights.
- I consent to my anonymised data being used in academic publications and presentations.
- I understand that my anonymised data will be stored for the duration outlined in the Participant Information Sheet.

Please tick yes or no for each of these statements.

1. I agree to being audio recorded.

|                          |                          |
|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> |
| Yes                      | No                       |

2. I allow my data to be used in future ethically approved research.

|                          |                          |
|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> |
| Yes                      | No                       |

3. I agree to take part in this study.

|                          |                          |
|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> |
| Yes                      | No                       |

Name of person giving consent

Date  
dd/mm/yy

Signature

Name of person taking consent

Date  
dd/mm/yy

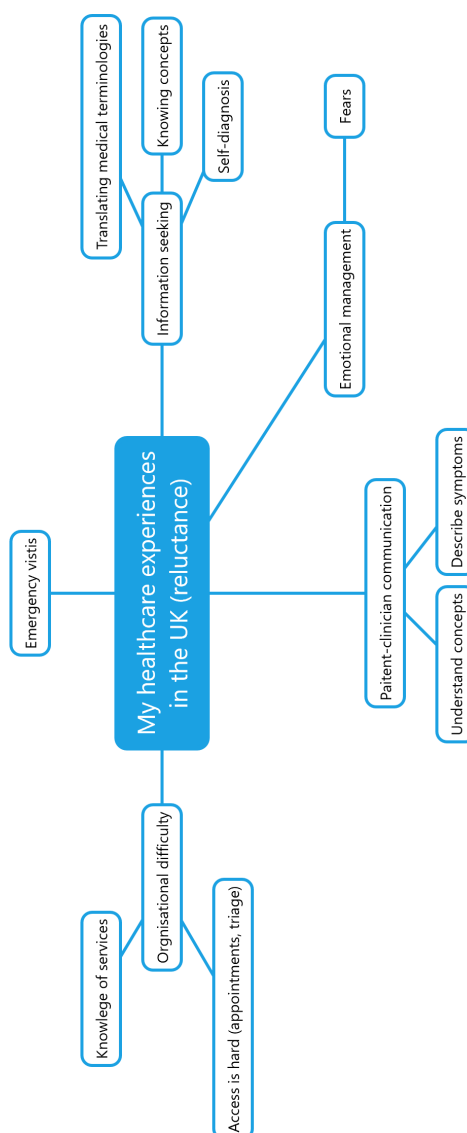
Signature

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**informatics**

## Appendix B: Study Materials for the Grounded Theory Study

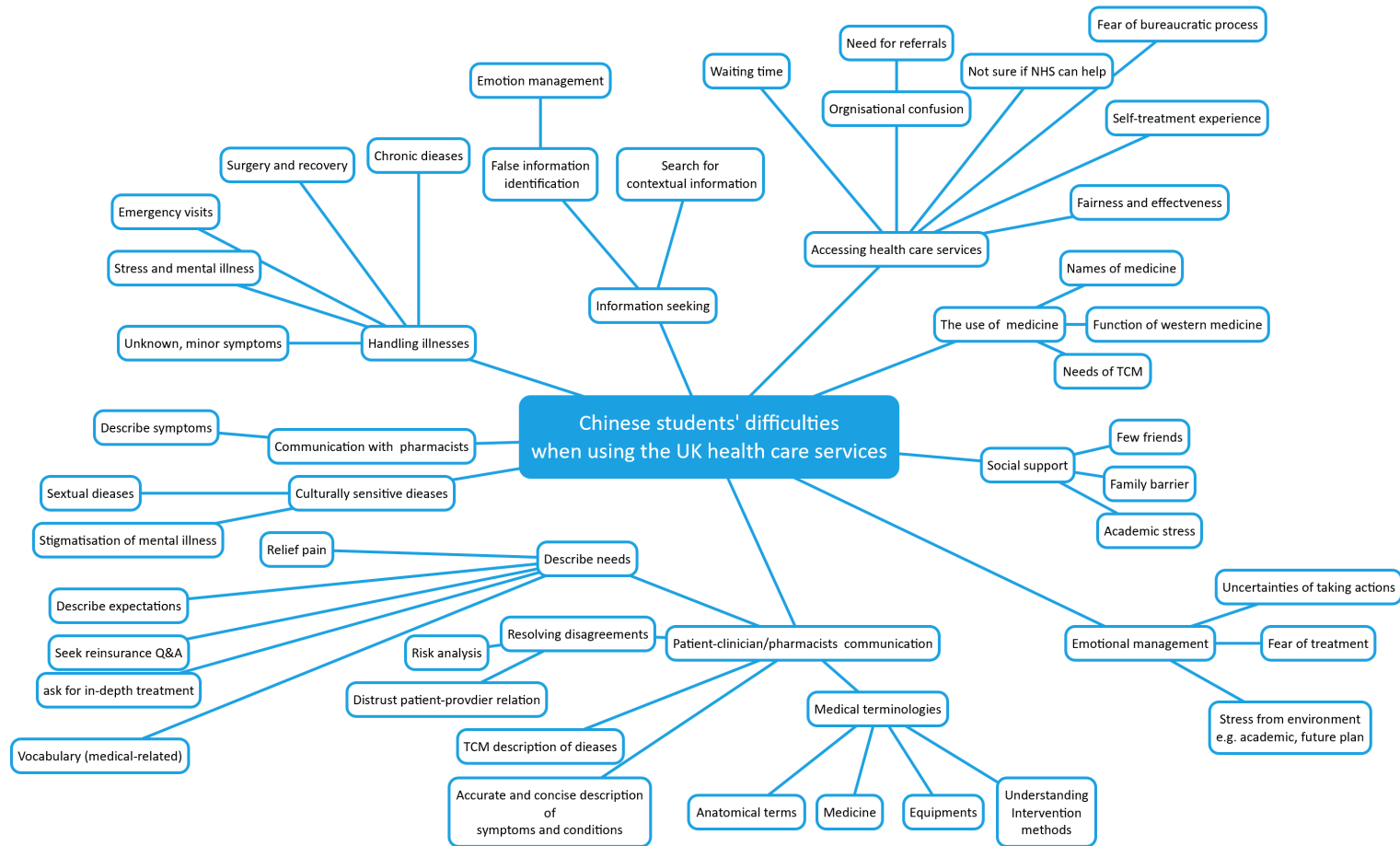
This appendix documents the materials which we used to collect and analyse interviews in Chapter 5, the Grounded theory study. Appendix B1 shows the interview schedule at the start of the iterative interview process. As the study proceeded, more and more topics were being identified, and the interview schedule evolved into Appendix B2. Appendix B3 shows the final version of the inductive codebook, which we used to analyse interview transcripts. It documents how we classify themes and sub-themes for the interviews.

### B1: Initial open topics for the Grounded Theory Study





## B2: Final interview schedule of the Grounded Theory Study



## B3: Codebook for the Grounded Theory Study

| Code Name                                                        | Description                                                                                                                                                                                                                          | Example                                                                                                                                                                                                    |
|------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Self-assessment of discomfort</b>                             | Thoughts, actions, and associated emotions that relate to the awareness of the discomfort. Usually includes self-explanation of the discomfort, assessment of illness and its impact, decision making and action-planning behaviour. | P: Initially, I felt that I could manage the problem by myself, but later it did not turn out well. Although I don't think it is serious, this is the thing I cannot explain, so I think I need some help. |
| - <b>Traditional Chinese medicine (TCM) concept descriptions</b> | The attempt to use the Traditional Chinese Medicine concept to explain, attribute causes, and rationalise the discomfort.                                                                                                            | P: I feel my body is very cold during the night, and this is the cause of the coughing because I only cough during the night.                                                                              |
| <b>Booking appointments</b>                                      | Actions and events are used to describe what Chinese students have taken or they think they should take to make appointments for accessing healthcare services. Their attitude toward the booking procedure.                         | P: I have filled out many forms to register for GP.<br>P: I phoned them to ask if they have any slots available ASAP, but they asked me to wait for a day or two.                                          |
| <b>China vs UK healthcare system</b>                             | Interviewee's attitude about (i.e., thoughts toward) the healthcare systems in China and the UK.                                                                                                                                     | P: I think the systems are very different. In China, you usually walk into the hospital and are done. It is very different here. It's more complicated.                                                    |
| - <b>Organisational difficulties</b>                             | Actual or perceived difficulties in accessing healthcare services which caused by institutional differences, or poorly organised information about the healthcare system (procedural, financial, structural, etc.).                  | P: I don't know which department I should go to. I think I am not allowed to go to the hospital if things are not deadly, right?                                                                           |
| - <b>Unique features of the UK healthcare system</b>             | Characteristics that the interviewee thinks which is unique to the UK healthcare system, and their attitudes, opinions, and thoughts on these unique characteristics.                                                                | P: NHS in the UK needs booking and references, whereas in China, you can just see a doctor within a day.                                                                                                   |
| - <b>Tactics to fit into the</b>                                 | The way that Chinese students use or have thought about                                                                                                                                                                              | P: NHS in the UK needs booking and references. It                                                                                                                                                          |

|                                                                        |                                                                                                                                                                                       |                                                                                                                                                                                                       |
|------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>UK healthcare system</b>                                            | makes it easier to reach the UK healthcare service (including mental preparations).                                                                                                   | takes time, so I usually just go to the pharmacy instead to solve my problem.<br>P: As I was unfamiliar with UK services, I looked up information online to see how others tackle similar situations. |
| <b>Patient-provider interaction</b>                                    | Things related to or happened while the patient (Chinese students) was interacting with the healthcare services.                                                                      | P: One of the challenges to accessing healthcare services is talking with clinicians.                                                                                                                 |
| - <b>DP interaction</b>                                                | Things relate to or happen when a patient interacts with doctors.                                                                                                                     | P: I often find it hard to communicate with the doctor. It could be just me, but I feel that I cannot understand what they are saying.                                                                |
| - <b>Short of time</b>                                                 | Not enough time for consulting and examination to fully address students' concerns                                                                                                    | P: Since the consultation only lasted around 10 minutes, I did not have enough time to challenge the doctor's decision.                                                                               |
| - <b>Challenging the outcome (usually associated with expectation)</b> | Thoughts and behaviours that challenge doctors' diagnosis. Or the desire to challenge it (reluctant acceptance).                                                                      | P: I would disagree with the doctor's advice as the treatment was quite different from China, but I did not speak out as I believe he was the professional.                                           |
| - <b>Making decisions</b>                                              | Actions that relate to deciding whether to proceed with medical interventions based upon personal judgements.                                                                         | P: The doctor asked me about whether or not I want to commit to surgery (or take medicine instead).                                                                                                   |
| - <b>Pragmatic issues</b>                                              | When talking to health professionals, difficulties or struggles to carry out conversations due to unfamiliar social and cultural contexts (processes), norms, and (medical) concepts. | Not aware of available options, ways to articulate the problem to let the doctor carry out treatments that he/she want.                                                                               |
| - <b>Culture-related issues</b>                                        | When talking to health professionals, attempts or struggles to use TCM terms to articulate the discomfort or illness.                                                                 | P: "Cold cough" – I think it is a TCM term that will be hard to be gripped by doctors in the UK.                                                                                                      |

|                                                      |                                                                                                                                                        |                                                                                                                                                                  |
|------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| - <b>Tactics for DP communication</b>                | The way that Chinese students or doctors resolve doctor-patient communication difficulties.                                                            | P: I think listening is the key. I can just say less and focus on what the doctor is saying.                                                                     |
| - <b>- Fully Informed</b>                            | Health professionals give information which the patient wants to ask, therefore removing concerns. This is often associated with positive experiences. | P: What I liked about this doctor is that he answered all my questions, and he even gave additional information that I did not ask.                              |
| - <b>- Showing empathy</b>                           | Aware of patients' concerns and trying to remove these concerns.                                                                                       | P: Although I had language difficulties, the doctor waited for me to finish describing the symptoms. He also used his phone to check if he understood correctly. |
| - <b>Preparation is being done for communication</b> | The action, opinions or psychological effort that the student has made in order to talk to the health professionals in the UK.                         | P: I usually look up keywords that might come up before the consultation.                                                                                        |
| - <b>Reflection on communication</b>                 | Reflections of DP-interaction and comments on how it can be improved.                                                                                  | P: I think doctors should behave more patiently and less judgemental in situations where we disagree with each other.                                            |
| <b>Handling emergencies</b>                          | Actions, thoughts and events that the interviewee faced or preparations they did to handle medical emergencies.                                        | P: Once, I accidentally cut my finger. Blood was bleeding quickly, so I called the resident assistant for help.                                                  |
| - <b>Communication under emergency circumstances</b> | Communication difficulties that Chinese students face when they are trying to handle medical emergencies.                                              | P: I called 999 to describe my situation. I don't think the conversation ran smoothly, as I have understood what they have said under extreme stress.            |
| <b>Handling chronic illnesses</b>                    | Actions, thoughts and events that the interviewee faced or preparations they did to manage chronic illnesses.                                          | P: I went to the GP to see if I and continue the prescription that I had in China.                                                                               |
| - <b>Communication</b>                               | Communication about chronic illnesses (usually with the                                                                                                | P: I told the doctor that I had this prescription                                                                                                                |

|                                                     |                                                                                                                                                                 |                                                                                                                                                                                                                           |
|-----------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>about chronic conditions</b>                     | doctor).                                                                                                                                                        | when I was in China, and wished him to prescribe the same medicine to me, but he told me that the UK does not use this medicine.                                                                                          |
| <b>Use of drugs</b>                                 | The thoughts and behaviour that relate to the purchase and the use of drugs.                                                                                    | P: If I have discomfort, I usually go to the pharmacy and buy medicine there. However, I have to ask the pharmacist as I am not very familiar with the drug names.                                                        |
| <b>Problems with accessing drugs via pharmacies</b> | Grey area for accessing drugs                                                                                                                                   | P: I visited a pharmacy to get some eye drops. I was refused by the pharmacist in the first store but approved by the pharmacist in the other store. This is confusing – are those eye drops being regulated? If so, how? |
| <b>– TCM drugs vs WM drugs</b>                      | Thoughts/attitudes that specifically relate to the comparison between TCM and WM drugs                                                                          | P: I bring drugs from China and rarely buy medicine here, as I prefer to take medicines which I am used to.                                                                                                               |
| <b>Language issues in healthcare management</b>     | The English problems that the student has had or anticipates having to manage their discomfort in the UK.                                                       | P: I am not familiar with medical terms. If I went to the GP, I would have to use body language to point out parts of my body rather than describe them.                                                                  |
| <b>- Understanding the Scottish accent</b>          | The difficulty in understanding Scottish accents while talking.                                                                                                 | P: I found the Scottish accent is often a challenge for me, especially on the phone, so calling 999 is just like a lottery.                                                                                               |
| <b>Expectations of visiting healthcare services</b> | Anticipations that the interviewee wants to get from the health professionals/health organisations, along with the sources from which these expectations arise. | P: I expect more professionalised, physical checks from the GP. Regular checks were not what I was going for.                                                                                                             |
| <b>- Fear of the unknown</b>                        | Anxiety grows from uncertainty (e.g. not knowing what to                                                                                                        | P: I was very worried because I had never                                                                                                                                                                                 |

|                                            |                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                   |
|--------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                            | do or what to expect, fear about unknown outcomes)                                                                                                                                                                                                                                                                                                             | encountered things (conditions) like that.                                                                                                                                                                                                                                                        |
| <b>Perception of value</b>                 | The perception of quality of the healthcare service being offered or received.                                                                                                                                                                                                                                                                                 | P: I feel that the GP is useless.                                                                                                                                                                                                                                                                 |
| - <b>Reinforcing expectations</b>          | Reinforcement of expectation due to 3 <sup>rd</sup> party opinions or ongoing or past experiences.                                                                                                                                                                                                                                                             | P: My colleagues told me that the GP is useless. They rarely do examinations.                                                                                                                                                                                                                     |
| <b>Help-seeking behaviour</b>              | The motivation and action to seek someone else's help (medical assistance, e.g., to relieve pain) to deal with discomfort, and practices to make help-seeking behaviour happen. This code is in contrast with the code of self-management and self-intervention of discomfort.                                                                                 | P: I don't know what to do at that time. You know, I'd like to talk to someone, but first, I don't have close friends here, and second, if I speak to my parents, then they will be worried. I eventually went to the mental health counselling service to see if I had any chance to be advised. |
| <b>Chinese experience living in the UK</b> | Interviewee's attitude (thoughts toward) the acculturation process to the UK society. This code describes the differences between living in the UK and China, like the environment, lifestyle, study patterns, etc. This code is more about the common knowledge about living in the two societies, which is beyond the differences in the healthcare systems. | P: I think you have to book everything in advance to receive services. This is not very common in China.<br>P: In China, education is more teacher and exam-driven. In the UK are more self-driven.                                                                                               |
| <b>Personal traits</b>                     | Statements of interviewees' own characterisation of themselves, and the way they attribute traits to explain certain behaviours.                                                                                                                                                                                                                               | P: Maybe I am just a lazy person. I do not feel that I want to register for the GP.                                                                                                                                                                                                               |
| <b>Mental health</b>                       | Things related to mental health management                                                                                                                                                                                                                                                                                                                     | P: I had a bad mood. I had a difficult time when I was preparing for the exam.                                                                                                                                                                                                                    |
| - <b>Mental health symptoms</b>            | Mental health problems/discomfort that the interviewee is experiencing or has experienced.                                                                                                                                                                                                                                                                     | P: I felt anxious and tired during that period, so I was wondering if I had depression... something like that.                                                                                                                                                                                    |

|                                                              |                                                                                                                                                                                                                                                                |                                                                                                                                                                 |
|--------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| - <b>Mental health causation and assessment</b>              | The cause of the mental health symptoms. This includes the doctor's professional assessment behaviour and the student's thoughts and assessment behaviour of their own.                                                                                        | P: I was wondering if I had depression or something because I spend a lot of time falling asleep.                                                               |
| - <b>Mental health intervention expectation and practice</b> | Interviewee's action, behaviour, and effort to relieve mental health discomfort. Also, the interviewee's expectations of interventions from mental health professionals. The actual intervention was given by the mental health professional.                  | P: I sometimes speak with my close friends to overcome my loneliness. However, they live in a different time zone, so I have to digest myself most of the time. |
| - <b>Difficulties in managing mental health problems</b>     | Challenges to managing mental healthcare problems. Can be challenges that they have experienced or challenges they think will happen.                                                                                                                          | P: I find it hard to describe what I experienced, and I know what I need to overcome the low mood.                                                              |
| - <b>Mental health issue expression</b>                      | Expressions are used to describe or articulate mental health discomfort. Often associated with the use of somatic expressions (e.g., the use fast heartbeat to describe anxiety).                                                                              | P: I felt heavy. I mean I felt tired to do anything.                                                                                                            |
| <b>Motivation to engage with health services</b>             | The motivation that the student decide to engage or not engage with the healthcare services. Often associated with the seriousness of the illness (i.e., perceived susceptibility and perceived severity), expectations and barriers to accessing the service. | P: I visited/want to visit GP because...                                                                                                                        |
| - <b>Time and effort</b>                                     | Perceived time and effort that is worthwhile to engage with the healthcare services.                                                                                                                                                                           | P: I think GPs are useless as I need to spend a lot of time preparing for the consultation. Sometimes I have to argue with the doctor to get what I want.       |
| - <b>Financial Considerations</b>                            | Things that relate to money when accessing healthcare services.                                                                                                                                                                                                | P: Considering the service is without charge, I thought, "Why not make use of it?"                                                                              |

|                                                            |                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                  |
|------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Online information searching</b>                        | The behaviour and the attitude towards looking for medical terms, or health-related information online, and learning medical knowledge to make sense of their discomfort.                                                                                      | P: I use online search engines to search for illnesses (I had) that I am not familiar with. The results might have lots of exaggerated descriptions, but I make my own judgements.                               |
| - <b>English vs Chinese searching behaviours</b>           | The discussion of online search results returned from different search engines. Google (English search engine) vs Baidu (Chinese search engine)                                                                                                                | P: I think Google returns more informative information, but Baidu often matches Traditional Chinese medicine terms, so I used them both.                                                                         |
| <b>Online support</b>                                      | Motivations, actions, and behaviours to seek online peer-to-peer support in order to relieve discomfort.                                                                                                                                                       | P: I asked my friends in the group chat to learn what to do (to make me feel better)                                                                                                                             |
| <b>Prior medical experiences</b>                           | Medical experience that the interviewee has had before, witnessed or has heard of. Medical experiences that guide their health beliefs (what they think to be the case) and health practices (how they would manage/plan their actions to relieve discomfort). | P: I had the same condition in China before. It got sorted quite quickly, so I expect the same thing to happen in the UK, but it is not the case. This makes to think that UK services are not efficient enough. |
| <b>Self-intervention of illness (individual practices)</b> | The action, thought, and motivation that the interviewee has taken or planning to take to manage their discomfort on their own. This code is often in contrast with help-seeking behaviour, which is about seeking other people's help.                        | P: If I feel discomfort, I would try to intervene myself because I know that accessing a GP needs waiting. It would be faster if I could fix the problem by myself.                                              |
| - <b>Planning ahead (anticipatory behaviour)</b>           | The precautionary action that the interviewee has taken or is planning to take to manage their health, and the rationale behind it.                                                                                                                            | P: I prepared a lot to convince the GP that I needed an examination because I knew they would be reluctant to refer me to the specialist.                                                                        |
| <b>Sources of health information</b>                       | Sources of health information to look up to, the knowledge they have learned in order to manage their discomfort, and their attitude towards these sources (e.g., accessibility and credibility)                                                               | P: I learned from the NHS website.                                                                                                                                                                               |



|                                                                              |                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                 |
|------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Sources of help and ways of support</b>                                   | Options to seek non-professional assistance when the interviewee is handling medical problems, and the interviewee's thoughts on these options.                                                                                                            | P: I used the TCM that my friend brought here.                                                                                                                                                                  |
| - <b>Self-disclosure behaviour</b>                                           | The thoughts and behaviours that relate to one's disclosure of discomfort to other people (non-health professionals). For professionals, refer to the code patient-provider interaction. This could be caused by individuals' attitudes or cultural norms. | P: I always dump my negative thoughts on friends around me. They are very kind and helpful. Always willing to listen to me.                                                                                     |
| <b>Traditional Chinese Medicine (TCM) beliefs and intervention behaviour</b> | The explanation (rationalisation) of discomfort or the cause of illness in using TCM terms, plus the action that they have taken to relieve the discomfort in the TCM way.                                                                                 | P: I cough a lot during night. I think I might have too much "Yin". My mother suggested I keep eating pears as it help with the Yin-yang balance.                                                               |
| <b>Personal beliefs and intervention behaviour</b>                           | Strong personal beliefs with associated with explanations of discomfort or the cause of illness, plus the actions that they think are correct to do.                                                                                                       | I had a high fever once. I think it is quite a serious issue, and I need to visit the doctor because I have always had medicines and injections (intravenous drips) back in China, and once I had a high fever. |
| <b>Emotional response</b>                                                    | Interviewees' emotional responses relate to their healthcare experiences. It could be frustration, enjoyment, anxiety, relief, or satisfaction. We use this code to outline the user journey.                                                              | P: I felt happy but exhausted after the consultation. Happy because it is not a serious problem. Exhausted because I felt anxious and tried a lot to describe my condition to the doctor.                       |
| - <b>Positive response</b>                                                   | Sentences that relate to positive healthcare experiences.                                                                                                                                                                                                  | P: NHS is good overall as it is accessible to everyone.                                                                                                                                                         |
| - <b>Negative response</b>                                                   | Sentences that relate to negative healthcare experiences.                                                                                                                                                                                                  | P: NHS is cumbersome to use as a foreigner.                                                                                                                                                                     |

Notes: This codebook is used for open coding (Saldana, 2016). Codes may overlap to capture subtle meanings.

## **Appendix C: Study Materials for the Co-design Workshop Study**

This appendix documents the materials which we used to set up the co-design workshop and analyse the data in Chapter 6, the Co-design workshop study. Appendix C1 documents the slide deck that we used to run the co-design workshop. Appendix C2 documents the template for the healthcare journeys activity, which we used to collect detailed students' healthcare service utilisation experiences. Appendix C3 documents the cards that we used to prompt the participants in the card-sorting activity. Appendix C4 documents the template that we used for the storyboarding activity. Appendix C5 documents the deductive codebook which we used to analyse qualitative data we collected in the workshop (for both data materials and audio transcripts).

## C1: Co-design Workshop Guide

### Designing Chatbots for Better Health Care Accessibility: A Co-design Workshop Study on Chinese Oversea students

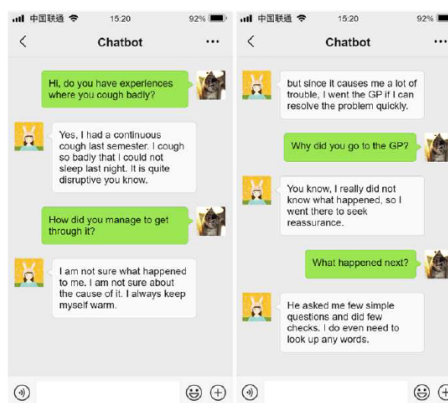
Liquan Chai, Dave Murray-Rust, Maria Wolters  
liquan.chai@ed.ac.uk, d.s.murray-rust@tudelft.nl, maria.wolters@ed.ac.uk



1

### Background

- Chinese students are the largest group of overseas students across the UK universities.
- However, being ill in a foreign country can be challenging.
- In a previous interview study, many Chinese students told me:
  - *"The NHS is hard to use. I don't want to use it."*
- **How** can we make the NHS easier to access for Chinese overseas students?
- **Basic idea:** Students talk to a chatbot that shares health care experiences. The chatbot helps them to make sense how the NHS works. See the **example** on right.



2

## Workshop Overview

**Key challenge:** What kind of contents should the chatbot tell, and how these stories being told?

**Activities:**

- 1. Experience journey mapping  
Illustrate a medical experience of yours on a sheet of paper
- 2. Grouping experiences  
Sort segments of events and arrange them into meaningful groups
- 3. Reflecting and designing a dialogue  
Pick a scenario and consider what would you like to be better  
How it can be addressed in the form of chatbot and draw an ideal use case
- 4. Rapid testing and final reflection  
Write down a dialogue and try it out the with the interviewer. What worked and what need to improve?

3

## Activity 0: Self-introduction

- How old are you? How long you have been in the UK?
- What are you studying? How do you feel about it?
- How would you characterise yourself (introverted/extroverted)? How's your student life overall?
- Please describe a medical experience that you have had in 3 sentences
- Example format:
  - What happened?
  - What did you do?
  - What happened in the end?

4

- **Task:** Talk through your experience in detail. Write down your **behaviours** and (potential) **fiction points** (i.e., events which you feel difficult to manage)
- Map segmented into 3 stages: before seeking help, during (self-) intervention, after seeking intervention
- Use post-it notes to fill out the map
- If you find difficult to think about what to talk about, you can go through these **example cards** to see which if the cards also applies to you. (see right, **bold** – behaviours, regular – fiction points)
- If a card apply in your case, place it in the map, and expend your notes from there.



## 6

## Activity 2: Grouping Experiences

Let's look back at your journey:

- **Task:** Take the sticky notes (behaviours and fiction points) off your map and **sort them into groups** that make sense to you.
- E.g., sort by, types of difficulty you have?
- E.g., sort by, behaviours that you think is important?
- E.g., sort by, thoughts or emotions that you have during the process?
- If you find difficult to group these behaviours and fiction points, you can look back to the **example cards** to see if any cards can describe your post-it notes. Place them into the group as well.
- Once you have done this, try to **name** these meaningful groups, and write them down in separate post-it notes.

7

## Activity 3: Reflecting and designing a dialogue

- **Task:** Decide a use case
- Pick one meaningful group that you feel particularly want to change. Try to answer to the following questions:
  - Why did you pick this group?
  - What do you think is the cause of the problem/difficulty?
- Imagine an ideal situation where no problems or difficulties at all. What would it be like? Try to answer the following questions:
  - What are you hoping for?
  - If the same thing happens in China, what do you think would be different?
  - What do you value most?
- Now, think about adding a chatbot. How a chatbot can be used to help you, or improve towards the ideal situation?
  - What the interaction would be?
  - What things might be useful to hear? (**Giving medical advice is NOT applicable**)

8

- **Task:** Storyboarding - Sketch a use case of the chatbot based on previous answers.

- **Context:** When to use the chatbot?

- E.g., Thinking about visiting the doctor, but not sure if it is necessary

- Goal: How the chatbot can help?

- E.g., I want to know about the cost involved

- **Type of interaction:** How the chatbot interact?

- E.g., “Chatbot, tell me what would be like if I visit GP” “That’s simple...”

- **Outcome:** How the chatbot changes the situation

- E.g., The chatbot will talk you through the process for consultation, and potential costs in the process, so that I know what to expect in the process.



- **Task:** Design a simple conversation script for the chatbot

- Look at the storyboard, think about the following questions:

- Look at the storyboard, think about the following questions:

- What are the key themes that the chatbot should address?

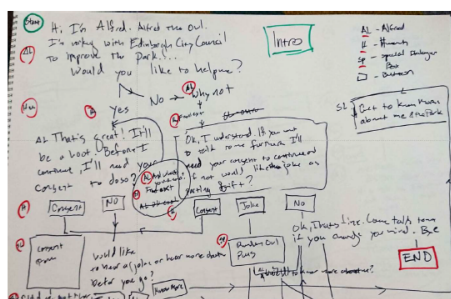
- What the actual conversation looks like? What is the user's input? How the chatbot will respond to the input?

- Develop dialogue script in the following structure:

- Intro - Start

- Main conversation (user input, chatbot

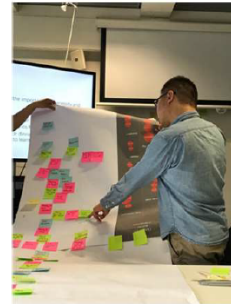
- Outro - End





## Activity 4: Rapid testing and final reflection

- **Task:** Rapid testing - Let's play out the script you have written.
  - The interviewer will be the chatbot, waiting for user input.
  - You will be the user, trying to use the chatbot
  - While testing it out, take notes on things that you find interesting or problems you have noticed about the dialogue script
  - Discuss with the interviewer about the following questions:
    - Is the dialogue fits the use case?
    - Is the dialogue flows naturally? Easy to understand? Easy to use? Any improvements?
    - To what degree do you think the dialogue is useful?

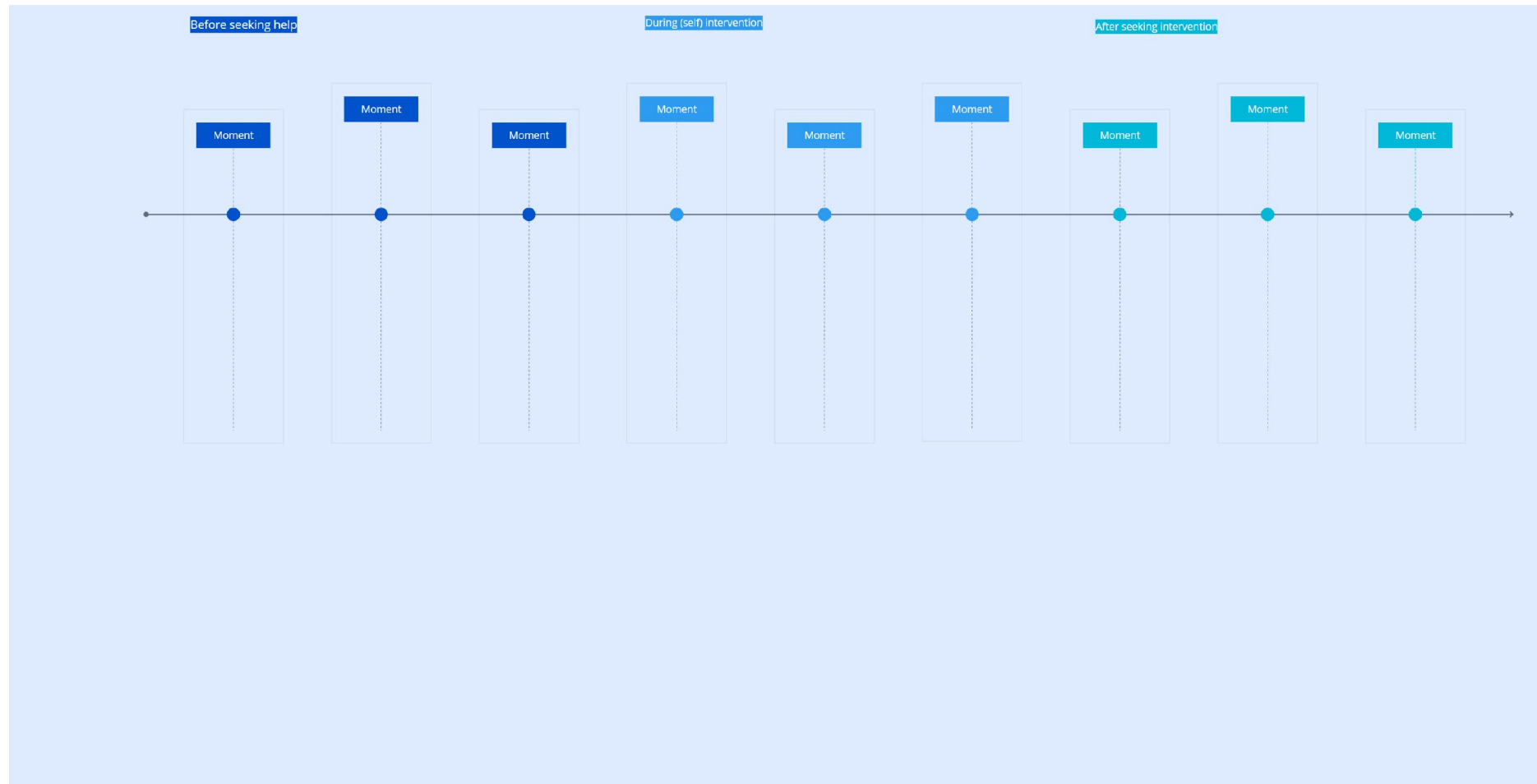


C2: Template for the Healthcare Journey Activity

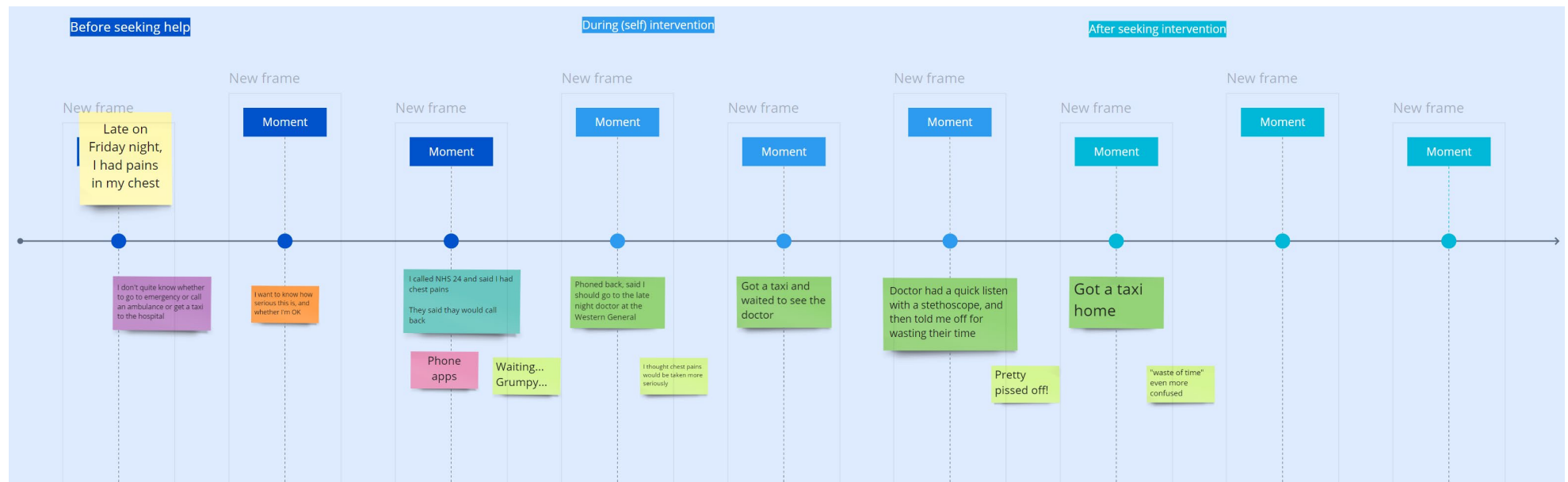
C2.1. Template Used in Pilot Studies:

|                                    |         |          |          |
|------------------------------------|---------|----------|----------|
| Post-screening                     |         |          |          |
| While screening                    |         |          |          |
| Engagement of health care services |         |          |          |
| Awareness of discomfort            |         |          |          |
| Phases                             | Actions | Thoughts | Emotions |

## C2.2 Template Used in Final Studies:



An illustrated example of the healthcare service utilisation journey:



### C3: Cards Prompts for the Card Sorting Activity

|                                                                                                                              |                                                                                                                                                   |
|------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>I ignore the symptom</b></p> <p>Before seeking help Behaviour</p>                                                      | <p><b>My effort of self-assessing the problem and finding possible treatments</b></p> <p>Before seeking help Behaviour</p>                        |
| <p><b>I sometimes lazy or shy or I believe I am strong and healthy (Personality)</b></p> <p>Before seeking help Friction</p> | <p><b>Seeking to learn from other people's health care experiences or other people's recommendations</b></p> <p>Before seeking help Behaviour</p> |
| <p><b>There's more important things to do than register with GP or visiting GP</b></p> <p>Before seeking help Friction</p>   | <p><b>Searching for information online</b></p> <p>Before seeking help Behaviour</p>                                                               |
| <p><b>I am worried about the outcome of the diagnosis</b></p> <p>Before seeking help Friction</p>                            | <p><b>I critically selecting useful information online</b></p> <p>Before seeking help Friction</p>                                                |

**I use different search terms to search  
for Chinese and English websites**

Before seeking help

Behaviour

**Making decisions go to the GP for the  
first time**

Before seeking help

Behaviour

**Some information online is too technical  
to understand**

Before seeking help

Friction

**Overcoming my reluctance to  
visit the GP**

Before seeking help

Behaviour

**I hold a strong belief about (a) certain  
health practices  
(e.g., use antibiotics when I am ill)**

Before seeking help

Friction

**Booking appointments**

Before seeking help

Behaviour

**Attach to Traditional Chinese Medicines**

Before seeking help

Friction

**I feel uncomfortable to talk about my  
symptom to professionals**

Before seeking help

Friction

It's just too much effort to book  
an appointment

Before seeking help

Friction

It's hard to find the right  
service when I am ill

Before seeking help

Friction

I live far away from the service

Before seeking help

Friction

I worried if my condition count as  
an emergency

Before seeking help

Friction

I am worried about communicating health  
matters in English

Before seeking help

Friction

**I prefer someone official to tell me my  
condition is an emergency**

Before seeking help

Behaviour

I sometimes find understanding  
accents difficult

Before seeking help

Friction

I am not sure who to call or where to go  
when I have an emergency (999, 111, GP,  
A&E)

Before seeking help

Friction

I find it hard to think clearly under  
emergency conditions

Before seeking help

Friction

I find it hard to manage multiple appoint-  
ments and visiting multiple services

Before seeking help

Friction

I find it hard to communicate clearly  
under emergency conditions

Before seeking help

Friction

**Changes of prescribed drugs  
relating to chronic illnesses**

Before seeking help

Behaviour

Not many people around when I am  
in emergency situations

Before seeking help

Friction

Differences in medicine between  
UK and China

Before seeking help

Friction

I don't know what to expect when I am in  
emergency situations

Before seeking help

Friction

My prior experiences in China conflicts  
with practices in the UK

Before seeking help

Friction



**I am uncomfortable to talk about  
my mental health issues to others**

Before seeking help

Behaviour

I think the counselor's advice is not  
practical in my situation

Before seeking help

Friction

I don't have many people to talk with  
when I have mental health issues (e.g.,  
impact on friendship)

Before seeking help

Friction

Counselor is not professional enough for  
my needs, I want to see a professional psy-  
chiatrist

Before seeking help

Friction

I don't think the mental health counselor's  
advice is relevant to me. I know myself  
better

Before seeking help

Friction

I prefer friends over mental health  
counselor to give me advice

Before seeking help

Friction

I don't know what to expect when I am in  
emergency situations

Before seeking help

Friction

It's hard to assess my own current mental  
health status

Before seeking help

Friction

**I use medicine to treat myself when I feel uncomfortable**

During (self-)intervention

Behaviour

**I bring domestic medicine from China**

During (self-)intervention

Behaviour

**I stick to known medicine which I know it works**

During (self-)intervention

Behaviour

I am unfamiliar with to how to buy different types of medicine in the UK (e.g., eye drops, antibiotics)

During (self-)intervention

Friction

**Borrowing Traditional Chinese Medicine from peers**

During (self-)intervention

Behaviour

Different pharmacies may have different decisions about which medicine to sell to you

During (self-)intervention

Friction

I am unfamiliar with medicines in the UK

During (self-)intervention

Friction

**I prefer to handle mental health problems myself**

During (self-)intervention

Behaviour

I have few trusted friends available  
to talk with

During (self-)intervention

Friction

I find it hard to understand medical con-  
cepts sometimes

During (self-)intervention

Friction

I am unfamiliar with what the school can  
offer for mental health support (e.g.,  
school's policy & resources)

During (self-)intervention

Friction

I find it hard to describe my symptoms and  
needs in the way that doctor can under-  
stand

During (self-)intervention

Friction

**Communicating with the doctor**

During (self-)intervention

Behaviour

**Negotiating with or ask for doctors  
about what your want**

During (self-)intervention

Behaviour

I feel it hard to use or understand medical  
terminologies in English

During (self-)intervention

Friction

**I would like to have a Chinese GP, a  
health professional or a translator**

During (self-)intervention

Behaviour

I not aware that I can, or I felt reluctant, to challenge my doctor’s decision

During (self-)intervention

Friction

**When interact with doctor, I want to know what’s wrong with me**

During (self-)intervention

Behaviour

I am not aware that I can, or I felt reluctant, to ask for referrals to specialists, private doctors or other alternative treatment options

During (self-)intervention

Friction

Doctor does not tell me the cause of the symptom

During (self-)intervention

Friction

I feel under pressure to talk to the doctor as the appointment is short

During (self-)intervention

Friction

**I want to be reassured when I counselling the doctor**

During (self-)intervention

Behaviour

Doctor only relies on what I tell them and they does not carry out tests

During (self-)intervention

Friction

I did not get the answer I was wanting or expected

During (self-)intervention

Friction

I want a cure (e.g., a specific treatment),  
but the doctor only wants to relieve the  
symptom

During (self-)intervention

Friction

I don't want to challenge the doctor

During (self-)intervention

Friction

My prior health experiences (e.g., in Chi-  
na) is different from doctor's advice

During (self-)intervention

Friction

I find it hard to talk about some sensitive  
topics during consultation  
(e.g., sexual related themes, suspected  
mental illnesses)

During (self-)intervention

Friction

Doctor only relies on what I tell them and  
they does not carry out tests

During (self-)intervention

Friction

**I am not happy with the NHS, and I  
prefer not to visit if possible**

After seeking intervention

Behaviour

**I am hoping to receive a treatment which  
not available in China**

After seeking intervention

Friction

**I need a lot of things to do and need  
time to prepare before the visit**

After seeking intervention

Behaviour

**I feel undervalued as a patient in the  
NHS**

After seeking intervention

Behaviour

**Booking appointments  
takes time and effort**

After seeking intervention

Friction

**I share negative experiences about the  
NHS to other people when I am frus-  
trated (TuCao)**

After seeking intervention

Behaviour

**I don't think the NHS's treatment  
will be effective**

After seeking intervention

Friction

C4: Template for the Storyboarding Activity

PERSONA:

USER STORY/SCENARIO:

PAGE #

PROJECT/TEAM:

DATE:

STORYBOARD [NNGROUP.COM](http://NNGROUP.COM)

## C5: Codebook for Co-design Workshop Analysis

|                                                                     |                                                                                         |
|---------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| Category: User characteristics                                      | Description: Characteristics for users' persona                                         |
| - Length of stay in the UK                                          | The time the participant has been in the UK                                             |
| - Familiarity with the healthcare service in the UK                 | Did the participant use any healthcare services in the UK? If so, how often?            |
| - Level of communication skills                                     | Did the participant feel confident about their English speaking in their daily routine? |
| - Prior healthcare experiences in China and specific health beliefs | What are the health beliefs that the participant holds? (This is largely inferred)      |

|                                                 |                                                                       |
|-------------------------------------------------|-----------------------------------------------------------------------|
| Category: Proposed use case                     | Description: Use case for the chatbot                                 |
| - When to use the chatbot (Chatbot use context) | The situation in which the chatbot can be used                        |
| - How the chatbot can help                      | How the chatbot features and functions solve or alleviate the problem |
| - Key elements to present                       | Key themes/the content of the script that the chatbot should present  |
| - Desired scenario                              | What does the outcome of the scenario look like?                      |

|                                                                   |                                                                                                                                                                                       |
|-------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Category: Dissatisfactions and their reasons                      | Description: Sentences that describe or infer dissatisfaction                                                                                                                         |
| - Inconsistencies in treatments                                   | One health professional or service suggested one thing, but another professional or service suggested another thing (e.g., Thoughts: Inconsistency & Randomness in Diagnosis Outcome) |
| - Not being valued or below the expectation                       | The feeling of being treated superficially, e.g., feeling that the doctor's advice is not useful. Their expectations are not being met when visiting the healthcare service.          |
| - Differences in common health practices between China and the UK | Differences in treatment routines between China and the UK                                                                                                                            |
| - Specialist vs Generalist                                        | Steps to receive treatments in the                                                                                                                                                    |



|                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                       |
|------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                  | generalist routine are different from the specialist routine (e.g., fundamental differences in healthcare systems between the UK and China, specialist vs GP, the UK's watch & wait strategy)                                                                                                                                                                                                         |
| - Attribution of responsibility                                                                                  | It is the patient's responsibility to provide information, vs. it is the doctor's responsibility to figure out the problem (e.g., not being proactive to question the doctor's advice or ask for alternatives)                                                                                                                                                                                        |
| - TCM is different from the WM                                                                                   | Ideas that describe the differences between the TCM treatment and the WM treatment. Prefer one over another.                                                                                                                                                                                                                                                                                          |
| - Other conflicts due to the strong belief or prior health experience in China                                   | Disagreement between the patient and the health professional as the patient has strong personal beliefs or similar medical experience in China (e.g., strong personal belief guided the intervention, strong personal belief in conflict with the doctor's suggestions)                                                                                                                               |
| - Demotivating factors for engaging the NHS                                                                      | Ideas that people do not want to contact the NHS to resolve their problem                                                                                                                                                                                                                                                                                                                             |
| - Overall negative impressions towards the NHS                                                                   | Opinions specifically towards the NHS or UK healthcare system (e.g., Feelings: General impression towards the NHS)                                                                                                                                                                                                                                                                                    |
| - Perceived costs (time, effort, cost) vs perceived benefits (severity and effectiveness of treatments) to visit | Evaluative comments about costs (time, cognitive & emotional effort, financial cost) to visit the service and the benefits that they will receive from visiting the service (effective treatments, relief)<br>(e.g., Practical reasons, Perceived time & efforts and benefits, Perceived time and effort (cost) vs Perceived benefit to receive treatment, Severity of the illness (minor condition)) |
| - Stressors for blocking engagement                                                                              | Stressful emotions which prevent them from engaging the healthcare services (e.g., Common stressors, academic stress, worried about the future, social                                                                                                                                                                                                                                                |

|                                           |                                                                                                                                  |
|-------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
|                                           | frictions (being too busy, not prioritising health))                                                                             |
| - - Influence from or to others           | Sharing negative healthcare experiences (e.g., negative stories, or “TuCao”)                                                     |
| - - Personality, unwillingness to engage  | Personal traits which make them feel uncomfortable engaging the healthcare service (e.g., laziness or shyness)                   |
| - Feels uncertain due to non-transparency | Feel uncertain about the amount of cost, time, and effort to spend, and do not know what to expect when going through a process. |
| - Other dissatisfaction and its reasons   | Other themes that are not included above                                                                                         |

|                                                                                                   |                                                                                                                                                                             |
|---------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Category: Perceived and encountered difficulties and causes                                       | Description: Problems or concerns that students have or are about to have when using the healthcare service                                                                 |
| - Not knowing the right service or not knowing the procedure to approach (Organisational barrier) | Not aware of which service to visit or simply don't have the knowledge to decide which service to go to (e.g., finding the right department to visit, finding the doors).   |
| - Language difficulties                                                                           | English problems and medical terminology problems (e.g., Linguistic barrier)                                                                                                |
| - Problems in registration and booking                                                            | Problems with registering the GP or booking appointments                                                                                                                    |
| - Problems in doctor-patient consultation                                                         | Problems about interacting with the doctor (e.g., Communication barrier, Short of time to interact, Respectful to professionalism/Reluctant acceptance/not being proactive) |
| - Hard to distinguish whether the condition is an emergency                                       | Hard to assess whether the condition counts as an emergency (under the UK definition)                                                                                       |
| - Hard to explain TCM beliefs to Western practitioners                                            | Hard to describe TCM concepts in a way that Western doctors can understand                                                                                                  |
| - Stigmatisation of certain symptoms or medicine                                                  | Concerns about disclosing the condition to others; not socially acceptable to use certain types of medicine                                                                 |
| - Differences in living habits between China and the UK                                           | Problems due to differences in living styles between British and Chinese (e.g.,                                                                                             |

|                                                        |                                                                        |
|--------------------------------------------------------|------------------------------------------------------------------------|
|                                                        | drinking honey water vs drinking porridge, making friends/socialising) |
| - Few social and interpersonal resources are available | Limited people are available to help when having medical conditions    |
| - Other difficulties and causes                        | Other themes that are not included above                               |

|                                                            |                                                                                                                                                                                                                                                                    |
|------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Category: Ways to cope and its problems                    | Description: Health coping strategies and their difficulties                                                                                                                                                                                                       |
| - Using and purchasing medicine and its problems           | Experiences around the use and purchase of medicine in the UK (e.g., bringing domestic medicine from China, purchasing drugs based on past medical experiences in the UK)                                                                                          |
| - Self-intervention and its strong beliefs                 | Preference of self-managing health conditions and the reasons behind them (e.g., Strong personal beliefs guided intervention, follow the TCM route, symptom ignorance or simply wait and see)                                                                      |
| - Help from peers and problems in seeking peers' help      | Experiences around helping others and problems about seeking others' help (e.g., Source of help and ways of support, From other people's experiences, Self-experience or advice received from health professionals in China, Self-disclosure behaviour of illness) |
| - Searching for information online and its problems        | Experiences about searching for information online and problems in online information searching (Search for health information online)                                                                                                                             |
| - Problems in handling emergencies                         | Problems that will be encountered under emergency conditions (e.g., Handling emergencies, Diminished cognitive functions in emergencies)                                                                                                                           |
| - Tactics to fit or make sense of the UK healthcare system | Techniques for students to adapt to the UK healthcare system (e.g., Tactics to fit the UK healthcare system, Sharing and learning from anecdotes and experiences, Shaping expectations)                                                                            |
| - Other ways to cope and their                             | Other themes that are not included                                                                                                                                                                                                                                 |

|          |                                        |
|----------|----------------------------------------|
| problems | above<br>(e.g., precautionary actions) |
|----------|----------------------------------------|

|                                        |                                                                                                |
|----------------------------------------|------------------------------------------------------------------------------------------------|
| Category: Strong emotions              | Description: Sentences which express or imply a strong emotion                                 |
| Positive emotions                      | Sentences which express or imply a strong positive emotion                                     |
| Negative emotions                      | Sentences which express or imply a strong negative emotion                                     |
| Things align with coders' experiences. | Experiences which align with the coder's own experiences, and they want to comment about them. |

## Appendix D: Study Materials for Chatbot Implementation

This appendix documents the materials which we used to design and implement the chatbot prototype in Chapter 7. Appendix D1 documents the user personas which we derived from the results in Chapter 6, the Co-design workshop. These personas illustrate potential target users of the chatbot prototype, including personal characteristics, impression towards NHS, pain points and their thoughts towards how a chatbot could be used to help them. Appendix D2 documents the dialogue flows and dialogue contents of the four use case scenarios that we designed for the chatbot prototype. This includes how the user can choose from different pre-defined questions to continue conversations with the chatbot prototype.

### D1: Personas for Chatbot Design

#### D1.1 Persona A: New Student

##### About A:

She is not familiar with the UK healthcare services and how to use them (section 4.2.2). She lives alone, so there are not many friends around her. She believes that her body is robust, and she can take care of herself. She does not want to put herself in unfamiliar situations, such as going to the doctor, because she does not know what to expect from the doctors (section 4.3.5). When ill, she prefers to use medications which she brought from China. She was not familiar with UK medications (section 4.2.6). If possible, she prefers to borrow TCM medications from others as she is familiar with those medications.

##### Impression about NHS:

"I don't know much about the NHS except I know that it has something to do with health. I have just registered the GP, but I never used it, and nobody talks about how it might be different from Chinese hospitals." (section 4.2.2)

##### Personal characteristics:

- Gender: Female
- Age: 23
- Study: MSc Computer Science
- Communication skills: CEFR B2, able to use English for daily activities. She

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>worried that she could not understand medical terms and concepts in English during the doctor's consultation</p> <ul style="list-style-type: none"> <li>• Time lived in the UK: 5 months</li> </ul>                                                                                                                                                                                                                                                                                                                          |
| <p>Possible healthcare service engagement context:</p> <ul style="list-style-type: none"> <li>• Registering with a GP (section 4.2.1)</li> <li>• Booking an appointment with the GP for minor problems (section 4.2.5)</li> <li>• Purchase and use of UK medications (section 4.2.6)</li> <li>• Consulting for minor problems (section 4.2.5)</li> <li>• Getting others for help in urgent situations (section 4.2.3)</li> </ul>                                                                                                |
| <p>Problems to be addressed based on the findings:</p> <ul style="list-style-type: none"> <li>• Registering a GP can be difficult (section 4.2.1)</li> <li>• Unfamiliar with common UK medications: how to use them and where to access them (section 4.2.6)</li> <li>• Unfamiliar with the UK healthcare services: what they do and how to access (i.e., book appointments with) them, particularly the GP (section 4.2.2)</li> <li>• Not understanding the doctor's advice during the consultation (section 4.2.5)</li> </ul> |
| <p>User wants:</p> <ul style="list-style-type: none"> <li>• Register with a GP successfully</li> <li>• Know how the GP works and when to seek help</li> <li>• Know how to access UK medications</li> <li>• Able to understand the doctor's advice</li> </ul>                                                                                                                                                                                                                                                                    |
| <p>Chatbot requirements:</p> <ul style="list-style-type: none"> <li>• A Chatbot that introduces the roles of different NHS services and ways to access them, GPs in particular</li> <li>• A Chatbot that provides information about ways to access UK medications</li> <li>• A "portal" to facilitate administrative matters such as GP registration, booking</li> <li>• A chatbot as a translation tool to facilitate communication in doctor consultations</li> </ul>                                                         |

### D1.2 Persona B: Adapting Student

#### About B:

She has some experience visiting the GP but not other services. It takes a lot of time and effort for her to wait and get advice from the GP. She lives in a student dormitory with a lot of other Chinese students. She usually hung out with her friends and helped each other. For minor problems that she has already experienced before, she prefers to ask others for help (they share medications that they brought from China). For unknown problems, she does not hesitate to go to the GP, but she is concerned about the time and effort that she needs to search for information online (section 4.2.7). She is also worried about the risk of having long waiting times and getting useless advice, so she only treats visiting the GP as a

"backup" option. During the doctor's consultation, her job is to provide as much information as possible for the doctor to diagnose. She treats GP doctors as professionals and never disagrees with them. She knows that she needs to call 999 in an emergency, but it is difficult for her to distinguish between minor, urgent and emergent illnesses (section 4.2.3). She is familiarised with certain UK painkillers, but she is not familiar with prescribed medications and the ways to obtain them. She prefers to have TCM medications.

**Impression about NHS:**

"I would like to see a doctor when I am ill, but I am worried about the cost and efficiency of reaching the GP (section 4.3.1). I may have to spend a lot of time and effort to prepare for the consultation, like making sense of the illness. I worried that the GP would give advice that I already knew. Also, I am not sure about what I am going to do if I have urgent and emergency conditions, and how I would be treated in these conditions (section 4.2.3, 4.3.5)."

**Personal characteristics:**

- Gender: Female
- Age: 25
- Study: Master's of Architecture
- Communication skills: CEFR C1, can use English fluently in daily activities, but is worried that she cannot express her symptoms and her needs precisely during the consultation.
- Time lived in the UK: 2 years.

**Possible healthcare service engagement context:**

- Accessing professional help in urgent situations or emergencies (4.2.3)
- Communication in GP consultations (section 4.2.5)
- Access and use UK-prescribed medications (section 4.2.6)

**Problems to be addressed based on the findings:**

- Unfamiliar with the UK medications: not familiarising with prescribed medications and how to use them (section 4.2.6)
- Handling urgent conditions and emergencies: hard to distinguish minor, urgent and emergency conditions and know what to do (section 4.2.2, 4.2.3)
- Hard to estimate the time, effort, and benefit of visiting the GP because of the potential delays in treatments (section 4.2.1, 4.3.5)
- Hard to articulate her problems and her needs clearly (section 4.2.5)

**User wants:**

- Know how to access UK-prescribed medications and know where to look them up
- Familiarise yourself with the urgent and emergency services in the UK
- Familiarise yourself with how the NHS works, particularly the way GPs process her issues
- Able to articulate her needs clearly to the doctor

**Chatbot requirements:**

- A Chatbot that provides information about UK medications, ways to access

and how to use them

- A Chatbot that provides information about the treatment process, particularly about urgent and emergency conditions
- A Chatbot that introduces relevant medical concepts that might come up in the consultation. Also, help her articulate problems clearly.
- A chatbot that can generate treatment plans according to her symptoms, with time estimates

### D1.3 Persona C: Acculturated Student

About C:

He has a lot of experience visiting the GP and has some experience with other NHS services, such as seeing hospital specialists. He uses various techniques to take advantage of the GP, such as exaggerating the condition to receive the doctor's attention. He lives in a rented flat with his roommate. However, he is not familiar with services other than the GP, so he does not know exactly how the treatment will be rolled out for complicated illnesses (section 4.2.2). He has had a chronic illness since he was back in China and continues his treatment in the UK (section 4.2.4, 4.3.4). Due to the differences in healthcare practices, his expectation often conflicts with the UK doctors (section 4.3.2), leading him to think that doctors in the UK, especially GPs, are unprofessional (section 4.3.3). He treats the NHS as a self-service toolbox (section 4.3.1). However, it is hard for him to know all available treatment options/tools while consulting with the GP (section 4.2.5). He feels that it is hard to challenge the doctor and negotiate alternative treatments (section 1.5). He also spends a lot of effort when engaging with multiple departments to resolve conflicting suggestions between them (sections 4.2.1, 4.3.1, 4.3.4). He is familiarised with common medications that are sold in the UK as well as prescriptions that he is using and how to access them, but he is not familiar with other prescriptions (section 4.2.6).

Impression about the NHS:

"My experience with the NHS isn't really good. It's not a problem of communication, but because the NHS is inefficient and the doctors are not professional (section 4.3.4, 4.3.2). The NHS is not a system to support you, but rather a toolbox. You have to find them to do things you want. (section 4.3.1) "

Personal characteristics:

- Gender: Male
- Age: 27
- Study: PhD
- Time lived in the UK: 7 years
- Communication skills: CEFR C1, can use English fluently in daily activities, and can understand what the doctor said in most cases, but is not familiar with healthcare contexts beyond GP consultations.



Possible healthcare service engagement context:

- GP Consultations: negotiating with the GP (section 4.2.5)
- Managing expectations of visiting the GP (section 4.3.2)
- Knowing the process of visiting different services (other than GP) (section 4.2.2, 4.3.4)

Problems to be addressed based on the findings:

- Not trusting the GP (4.2.5, 4.3.1)
- Unhappy about unmet expectations and argues with the GP about her needs. He feels that the doctor does treat him seriously enough (section 4.2.5, 4.3.2)
- Do not be aware of available treatment options and negotiate with the GP to find out the best treatment plan (section 4.2.5)
- Do not know the process of having specialised and chronic treatment (section 4.3.5), and hard to estimate the time and effort of having such treatment. (section 4.2.2)

User wants:

- Familiarise with the roles of different NHS services and how NHS services other than the GP process his issues
- Able to persuade the doctor and negotiate with doctors about treatment options

Chatbot requirements:

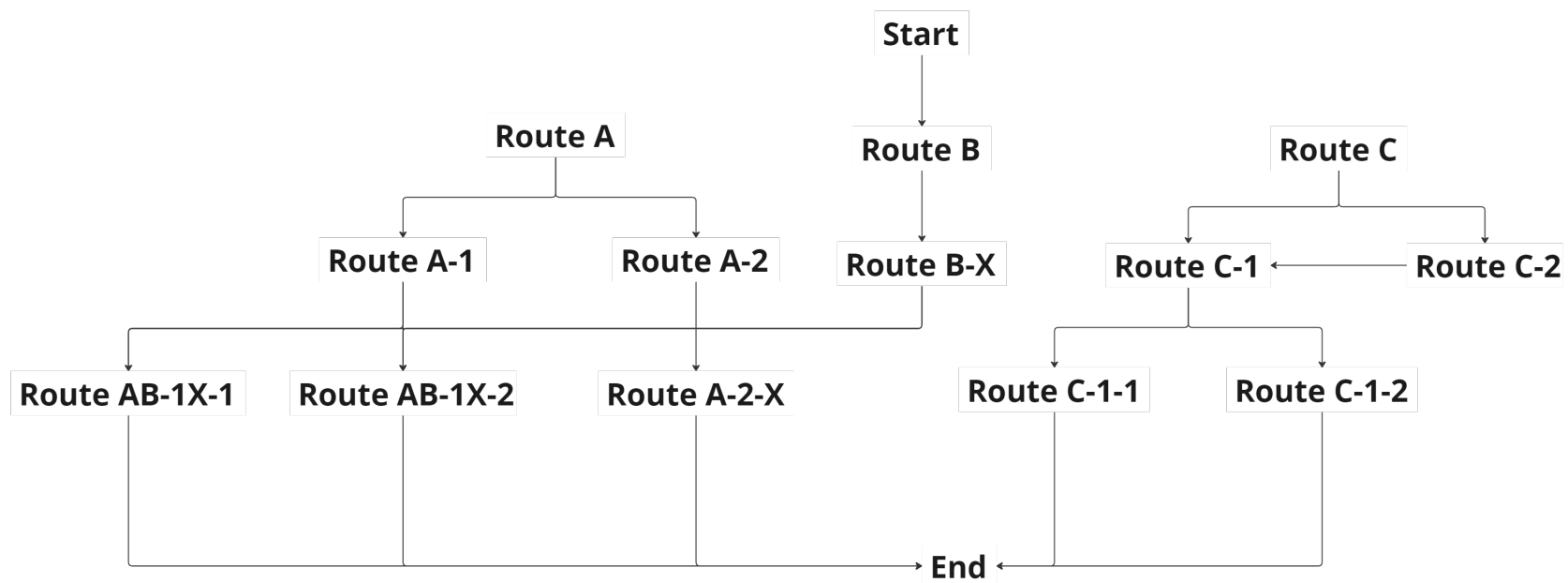
- A chatbot to inform the responsibilities of all NHS services; therefore, helping him to manage expectations
- A chatbot that teaches him about negotiation techniques for discussing treatment plans and teaches him about communication tactics to make the doctor treat him seriously

## D2: Conversation Flows of the Chatbot Prototype

The integrated charts of dialogue flows and contents are available at: [https://miro.com/app/board/uXjVN-cyxVI=/?share\\_link\\_id=621826118556](https://miro.com/app/board/uXjVN-cyxVI=/?share_link_id=621826118556).

### Use Case Scenario 1: UK Healthcare System Overview

Dialogue Flow:



## Dialogue Content:

| Content_ID,<br>State_ID | Dialogue Content                                                                                                                                                                                                                                                                                                                                                                                                                 | Follow-up Options                                                                                                                                                                                                                          |
|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Start, s_0              | <p>Hi there! I am a bot which is designed to help you understand how the UK healthcare system works. I am still in development, but I will try my best to answer your questions.</p> <p>What do you want to know about?</p>                                                                                                                                                                                                      | <ol style="list-style-type: none"> <li>1. What is the healthcare system in the UK? How is it different from China?</li> <li>2. What services does the NHS offer?</li> <li>3. I have just arrived in the UK. How to use the NHS?</li> </ol> |
| Route A, s_1            | <p><b>What is the healthcare system in the UK? How is it different from China?</b></p> <p>The healthcare system in the UK is called the National Health Service (NHS). In China, the healthcare system is insurance-based. In the UK, the healthcare system is residence-based. In China, the healthcare system is hospital-based. In the UK, the healthcare system is referral-based.</p> <p>What do you want to know next?</p> | <ol style="list-style-type: none"> <li>1. What is a "residence-based" system?</li> <li>2. What is a "referral-based" system?</li> </ol>                                                                                                    |
| Route A-1, s_2          | <p><b>What is a residence-based system?</b></p> <p>This means that anyone who lives in the UK can use healthcare services mostly free of charge. However, residence-based also means you have to wait, and doctors will restrict the number of</p>                                                                                                                                                                               | <ol style="list-style-type: none"> <li>1. What is different about private services?</li> <li>2. Will I receive the same service quality across the UK?</li> </ol>                                                                          |

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                    |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|
|                    | <p>examinations and treatment options you have.</p> <p>The NHS aims to provide affordable service to everyone, so you cannot expect it will be as efficient as the Chinese system. The private service offers faster services and fewer restrictions.</p> <p>What do you want to know next?</p>                                                                                                                      |                                                                                                                    |
| Route A-2, s_5     | <p>What is a referral system?</p> <p>It means the GP have to refer you before you go to the hospital to see a specialist or carry out examinations.</p> <p>This is very different from China, where you simply go to the hospital and register with a doctor.</p> <p>What do you want to know next?</p>                                                                                                              | <p>1. How does the referral system affect me?</p> <p>2. Will I receive the same service quality across the UK?</p> |
| Route AB-1X-1, s_3 | <p><b>What is different about private services? How do I access them?</b></p> <p>Private services usually provide faster services, so you don't have to wait long. They also provide unique treatment plans that go beyond NHS standards to meet your needs. However, this means more costs, and they do not guarantee better treatments.</p> <p>If you think you need to use private services, you can ask your</p> | <p>1. Show me the summary - End of the conversation</p>                                                            |

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                  |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|
|                    | GP about private options.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                  |
| Route AB-1X-2, s_4 | <p><b>Will I receive the same service quality across the UK?</b></p> <p>Yes. The NHS provides treatments with consistent standards. Each region has their NHS subsystem, which offers the same service. There is no point in visiting different hospitals for better treatments.</p> <p>However, there will be slight differences across countries. For example, in Scotland, you don't have to pay for prescriptions, but this does not apply in England. The "NHS" is country-dependent. There are 4 different NHS in the UK, NHS England, NHS Scotland, NHS Wales and the Health and Social Care (HSC) in Northern Ireland. Each organisation has their own policies about costs and treatments, but similar in the way that you will be treated.</p> | 1. Show me the summary - End of the conversation |
| Route A-2-X, s_6   | <p><b>How does the referral system affect me?</b></p> <p>This means you have to interact more with the doctors. It is not only about following the doctor's advice. You are responsible for telling all of your problems, concerns and even the treatment you want.</p> <p>For example, if the GP thinks that your problem is minor, they will not refer you to further examinations.</p> <p>If you disagree with them, you should speak to the GP directly.</p>                                                                                                                                                                                                                                                                                         | 1. Show me the summary - End of the conversation |

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                      |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|
|                | This is important as you do not want to spend extra days or weeks resolving your problem.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                      |
| Route B, s_7   | <p><b>What services does the NHS offer?</b></p> <p>The NHS covers most services you need. They are categorised by primary services, secondary services and Accident &amp; Emergency (A&amp;E).</p> <p>The primary services are to do initial assessments, such as pharmacies, General Practitioners (GPs), dentists, and opticians. They handle minor illnesses and regular check-ups. Primary services are your first point of contact when you have problems.</p> <p>The secondary services are specialist doctors in hospitals. They carry out examinations and operations. You can only be referred to see a specialist.</p> <p>The urgent or A&amp;E services deal with urgent or life-threatening problems. You can call 111 (urgent) or 999 (A&amp;E) to access them.</p> <p>What do you want to know next?</p> | 1. The cost of NHS services                                                                                          |
| Route B-X, s_8 | <p><b>Do I have to pay for NHS services?</b></p> <p>No. They are free in most cases. The NHS is publicly funded and aims to provide affordable healthcare to everyone. This includes GP consultations, specialist examinations, emergencies, calling</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <p>1. What is different about private services?</p> <p>2. Will I receive the same service quality across the UK?</p> |

|              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                            |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
|              | <p>ambulances, and getting prescribed medicines.</p> <p>Some private services also offer NHS options. Dentists offer free dental check-ups. However, if you want to carry out treatments, you have to pay them in full as they are private.</p> <p>What do you want to know next?</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                            |
| Route C, s_9 | <p><b>I have just arrived in the UK. How to use the NHS?</b></p> <p>First - register with a General Practitioner (GP). Except for urgent conditions, the GP is always the first point of contact if you have health problems. You may want to choose the GP that is closest to you. People who live in the UK have the responsibility to register with a GP.</p> <p>Second - book an appointment with the GP. You can call your local GP to make an appointment, or you can use their online booking system if they have one.</p> <p>Third - visit the GP. The GP will carry out an initial assessment. You will be given prescriptions if necessary. If the doctor thinks you need further examinations, they will refer you to other services. The GP is your "gatekeeper" of the NHS, so registering with them is important.</p> <p>Under urgent cases where you think you cannot wait for the</p> | <ol style="list-style-type: none"> <li>1. How to register with a GP?</li> <li>2. What happens if I do not register with the GP?</li> </ol> |

|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                             |
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|                   | <p>appointment, call 111.</p> <p>What do you want to know next?</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                             |
| Route C-1, s_10   | <p><b>How to register with a GP?</b></p> <p>First - Pick a GP. It is usually the GP who is nearest to where you live.</p> <p>Second - submit the application form. Different GPs have different ways to submit the form. It is important to look at their website to find out their ways to submit them. When filling out the form, you will be asked for personal details and medical history.</p> <p>In practice, the GP will restrict the number of patients that they are taking. This often happens at the start of the academic year, so it is important to register early.</p> <p>You can find the list of GPs in your area by inputting your postcode here (Scotland):<br/> <a href="https://www.NHSinform.scot/scotlands-service-directory/GP-practices">https://www.NHSinform.scot/scotlands-service-directory/GP-practices</a></p> <p>What do you want to know next?</p> | <ol style="list-style-type: none"> <li>1. What to bring to register with a GP?</li> <li>2. How to change the GP?</li> </ol> |
| Route C-1-1, s_11 | <p><b>What to bring to register with a GP?</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <ol style="list-style-type: none"> <li>1. Show me the summary - End of the conversation</li> </ol>                          |

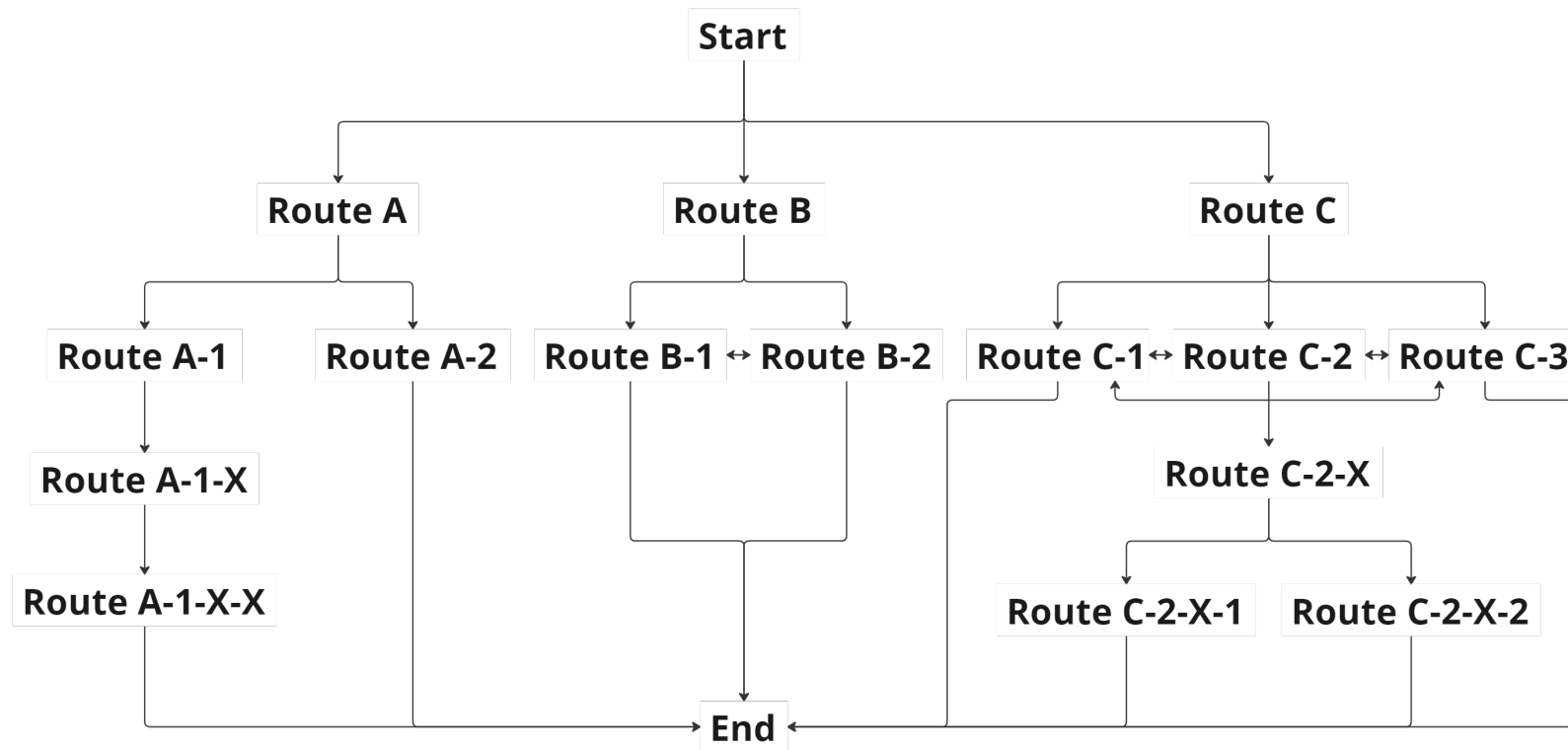


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|                   | Bringing a valid ID (e.g., passport) and proof of address (utility bill) will generally be helpful. However, different GPs have different policies.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                  |
| Route C-1-2, s_12 | <p><b>How to change the GP?</b></p> <p>If you are not happy with the current GP, or you have moved to a new place, you should change the GP.</p> <p>Contact a new GP and tell them that you want to register with them. Give them the contact details of your old GP. The NHS will automatically transfer your health records to them.</p> <p>For more information about the data transfer, please see the link below: <a href="https://www.nhsinform.scot/care-support-and-rights/nhs-services/doctors/transfer-of-your-gp-health-records/#moving-your-health-records">https://www.nhsinform.scot/care-support-and-rights/nhs-services/doctors/transfer-of-your-gp-health-records/#moving-your-health-records</a></p> | 1. Show me the summary - End of the conversation |
| Route C-2, s_13   | <p><b>What happens if I do not register with the GP?</b></p> <p>You are not able to see specialists or get prescriptions. You can still use urgent services or A&amp;Es, but you need to go through extra steps to set up your medical record, so it is important to register with a GP.</p> <p>What do you want to know next?</p>                                                                                                                                                                                                                                                                                                                                                                                     | 1. How to register with a GP?                    |
| End, s_14         | <b>End of the conversation: What to take away?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | N/A                                              |

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|  | <p>The healthcare system in the UK is a residential, referral-based system. Primary services, such as the GP and pharmacies, are your first point of use for using the NHS. You should register with a GP as soon as possible. Compared with the Chinese healthcare system, it costs less, but you have to wait longer. Private services offer quicker access, but this means more costs, and it does not guarantee better treatments.</p> |  |
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#### **Use Case Scenario 2: Self-management and Purchase of Medicines in the UK**

Dialogue Flow:



Dialogue Content:

| Content_ID,<br>State_ID | Dialogue Content | Follow-up Options |
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|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                |
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| Start, s_0     | <p>Hi there! I am a bot which is designed to help you with health management, especially with using and purchasing medicines in the UK. I am still in development, but I will try my best to answer your questions.</p> <p>What do you want to know?</p>                                                                                                                                                                                                                                                      | <ol style="list-style-type: none"> <li>1. What should I do if I am slightly ill?</li> <li>2. Are medicines which sell in the UK the same as those in China?</li> <li>3. I feel anxious to talk to the pharmacist. What should I do?</li> </ol> |
| Route A, s_1   | <p><b>What should I do if I am slightly ill?</b></p> <p>First, you need to understand your condition. You can look it up on the NHS website. It will ask about your symptoms, and then give information about the illness and the medicine you need. After that, you can visit a pharmacy to buy that medicine.</p> <p>If you are still not sure, ask a pharmacist. The pharmacist can give you medical advice, beyond recommendations on medicines. You don't need any appointments to see a pharmacist.</p> | <ol style="list-style-type: none"> <li>1. How can the pharmacy help if I am slightly ill?</li> <li>2. Where should I look to understand my condition?</li> </ol>                                                                               |
| Route A-1, s_2 | <p><b>How can a pharmacy help if I am slightly ill?</b></p> <p>You can buy medicine at the pharmacy under a pharmacist's guidance.</p> <p>Pharmacists in the UK are qualified health professionals who are responsible for giving you advice on minor conditions. They will ask about your symptoms, and they will give medicine recommendations or refer you to other services if they think you</p>                                                                                                         | <ol style="list-style-type: none"> <li>1. How are pharmacies in the UK different from China?</li> </ol>                                                                                                                                        |

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|                    | need them. For example, they will book a GP appointment for you if they think you need prescribed medicines.                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                 |
| Route A-1-X, s_3   | <p><b>How are pharmacies in the UK different from China?</b></p> <p>You can do many things in the pharmacy. As part of the primary care, they also offer things like emergency contraception (避孕) and flu jabs (流感疫苗接种).</p> <p>The UK pharmacies are also in charge of assessing your conditions. They will assess your condition to decide whether you need restricted medicines. They will help you to book other services (e.g., your GP, dentist, optician) if you don't have the prescription.</p> | <p>1. How to buy restricted or prescribed medicines in the UK?</p> <p>2. Show me the summary - End of the conversation</p>                      |
| Route A-1-X-X, s_4 | <p><b>How to buy restricted or prescribed medicines in the UK?</b></p> <p>You cannot buy restricted or prescribed medicine without permission from health professionals. The easiest way is to ask your GP to give you a prescription. Some pharmacists also qualify for prescriptions. Opticians and dentists are also allowed to prescribe eye or tooth-specific medicines. They will assess your condition first to decide if you need it.</p>                                                        | <p>1. What if the pharmacist refuses to sell me restricted or prescribed medicines?</p> <p>2. Show me the summary - End of the conversation</p> |
| Route A-2, s_5     | <p><b>Where should I look to understand my condition?</b></p> <p>The NHS website provides a wide range of information, including self-diagnosis, information about illnesses and medicine. You may want to understand your condition before you consult with</p>                                                                                                                                                                                                                                         | <p>1. Show me the summary - End of the conversation</p>                                                                                         |

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|                | <p>the GP or pharmacist. It is important to look up information from trustworthy sources, as results from search engines can be misleading. More information about self-diagnosis can be found here: <a href="https://www.nhsinform.scot/symptoms-and-self-help">https://www.nhsinform.scot/symptoms-and-self-help</a>, and more information about medicines can be found here: <a href="https://www.nhs.uk/medicines/">https://www.nhs.uk/medicines/</a></p>                                                                                                              |                                                                                                                                             |
| Route B, s_6   | <p><b>Are medicines sold in the UK the same as those in China?</b></p> <p>No. Many medicines which are sold in China are Traditional Chinese Medicines (TCMs 中医) or combinations of Western Medicines (WMs 西医) and TCMs. TCMs are not mainstream in the UK. You cannot expect UK doctors to offer TCMs to you. More information about using TCMs in the UK can be found here: <a href="https://www.nhs.uk/conditions/complementary-and-alternative-medicine/">https://www.nhs.uk/conditions/complementary-and-alternative-medicine/</a></p>                                | <p>1. What kinds of medicine are sold in the UK?</p> <p>2. I am somewhat ill. What medicine should I use?</p> <p>How to get them?</p>       |
| Route B-1, s_7 | <p><b>What are the medicines in the UK? Where do I buy them?</b></p> <p>Same as in China, you can buy some medicines Over The Counter (OTC). OTC medicine is mostly painkillers or cough remedies (止咳药). You can buy them in any pharmacies and even supermarkets. Some medicines need a pharmacist's approval before you can buy them. They are called restricted medicines, for example, eye drops and contraceptive (避孕) medicines. Other medicines are Prescribed Only Medicine (POM). You can only buy them if you have a prescription, for example, antibiotics.</p> | <p>1. I am somewhat ill. What medicine should I use?</p> <p>How can I get them?</p> <p>2. Show me the summary - End of the conversation</p> |

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| Route B-2, s_8  | <p><b>I am somewhat ill. What medicine should I use? How to get them?</b></p> <p>If you are not familiar with the medicines in the UK, you can look up the NHS's website to learn more: <a href="https://www.nhs.uk/medicines/">https://www.nhs.uk/medicines/</a>.</p> <p>If you do not know which medicines to take, you can search for symptoms and then look for the medicine. After having an initial idea, you can speak to the pharmacist to get the medicine. The pharmacist will help you out even if it is a restricted medicine or a prescribed medicine.</p> | <ol style="list-style-type: none"> <li>1. What kinds of medicine are sold in the UK? Where do I buy them?</li> <li>2. Show me the summary - End of the conversation</li> </ol>                                                                                            |
| Route C, s_9    | <p><b>I feel anxious to talk to the pharmacist. What should I do?</b></p> <p>You may be anxious when speaking to the pharmacist for the first time, so preparing what to say before seeing the pharmacist can make your life easier.</p>                                                                                                                                                                                                                                                                                                                                | <ol style="list-style-type: none"> <li>1. How should I describe medicine in the UK?</li> <li>2. I am not very confident about my English. What should I do?</li> <li>3. Should I tell the pharmacist if I am taking the Traditional Chinese Medicine (TCM 中医)?</li> </ol> |
| Route C-1, s_10 | <p><b>How do I describe medicine in the UK?</b></p> <p>In the UK, medicines have 2 names. The brand name and the generic name. The brand name is the name given by the manufacturing company (厂商). The generic name is given based on the medicine's key ingredients (成分). Doctors and pharmacists use generic names because medicines with the same generic name function the same.</p>                                                                                                                                                                                | <ol style="list-style-type: none"> <li>1. I am not very confident about my English. What should I do?</li> <li>2. I am talking to TCM right now. Should I tell the pharmacist about this?</li> <li>3. Show me the summary - End of the conversation</li> </ol>            |

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| Route C-2, s_11      | <p><b>I am not very confident about my English. What should I do?</b></p> <p>This is absolutely normal. You may not know the medical terminology in English, or you may not know the medical concept. It is always good to know what's coming up when interacting with the pharmacist. Looking up information from the NHS website will help you know English terminology and its meanings. The pharmacist will use a similar diagnosis process to the NHS website to assess you.</p> | <p>1. What will happen in the pharmacy? What things should I prepare?</p>                                                                                         |
| Route C-2-X, s_12    | <p><b>What will happen in the pharmacy? What should I prepare?</b></p> <p>At the pharmacy, you may be expected to talk about the following topics:</p> <ul style="list-style-type: none"> <li>- describe your symptom</li> <li>- listen to advice on medications (e.g., which medicine to buy)</li> <li>- procedures about referring you to another healthcare professional and their reasons (usually GP - for obtaining the prescription)</li> </ul>                                | <p>1. What if the pharmacist refuses to give me the medicine I want? (like prescribed medicines)?</p> <p>2. How to prepare before speaking to the pharmacist?</p> |
| Route C-2-X-1 , s_13 | <p><b>What if the pharmacist refuses to give me the medicine I want?</b></p> <p>Pharmacists have the right to refuse to buy restricted or prescribed medicine (if you don't have the prescription). It is important to fully describe your condition and all your concerns to the pharmacist to avoid misunderstandings. Also, it is okay to challenge them if you think they are wrong. If they still disagree with you, you can simply go to another pharmacy or your GP to</p>     | <p>1. Show me the summary - End of the conversation</p>                                                                                                           |

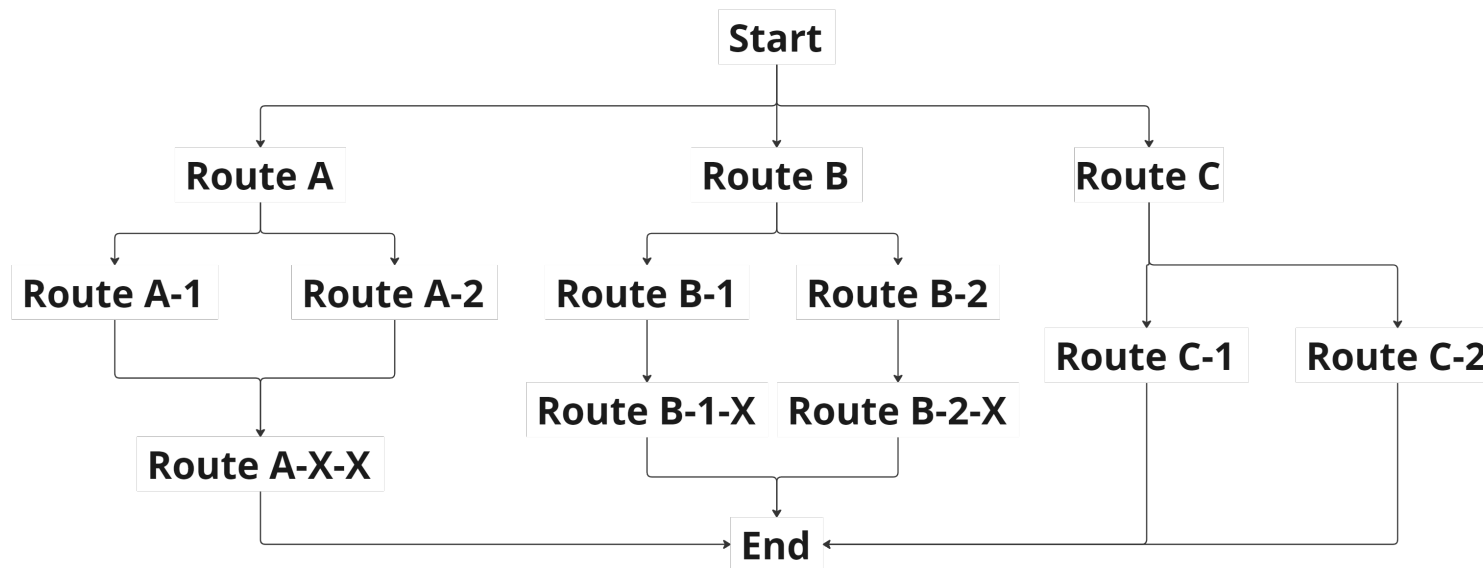


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|                     |  | get the medicine.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                   |
| Route C-2-X-2, s_14 |  | <p><b>How to prepare before speaking to the pharmacist?</b></p> <p>If you are worried about medical terminologies (医学术语), you can use translation apps such as Google Translate. Don't worry about the accuracy, as pharmacists are experienced professionals. They can pick up your idea quickly.</p> <p>If you are worried about knowing medical concepts, you can look up the NHS website: <a href="https://www.nhsinform.scot/symptoms-and-self-help">https://www.nhsinform.scot/symptoms-and-self-help</a>.</p> <p>If you are worried about knowing UK medicines, you can look up the NHS website: <a href="https://www.nhs.uk/medicines/">https://www.nhs.uk/medicines/</a> by using their generic name.</p> | 1. Show me the summary - End of the conversation                                                                                                                                  |
| Route C-3, s_15     |  | <p><b>Should I tell the pharmacist if I am taking Traditional Chinese Medicine (TCM 中医药)?</b></p> <p>Yes. If you are taking TCM and wish to discuss your health matters, you should tell the health professional about any TCM medicines that you are taking. Also, you may want to avoid taking TCM when you are taking Western medicines to avoid unknown interactions.</p>                                                                                                                                                                                                                                                                                                                                      | <p>1. I am not very confident about my English. What should I do?</p> <p>2. How should I describe medicine in the UK?</p> <p>3. Show me the summary - End of the conversation</p> |
| End, s_16           |  | <p><b>End of the conversation: What to take away?</b></p> <p>If you feel slightly or somewhat ill, the first step is to understand</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | N/A                                                                                                                                                                               |

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|  | <p>the condition. You can look up the NHS's website for information about symptom diagnosis and treatments. Visiting the pharmacy is the quickest way to get in touch with the NHS. Pharmacists will assess your condition and then give medical advice and refer you to other services if needed. When talking to pharmacists, don't be anxious. It is a good idea to speak about all your symptoms and your concerns. In this way, the pharmacist can assess your condition completely.</p> |  |
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**Use Case Scenario 3: Handling urgent conditions and emergencies in the UK, Use of Emergency Services.**

Dialogue Flow:



Dialogue Content:

| Content_ID,<br>State_ID | Dialogue Content                                                                                                                                                                                | Follow-up Options                                                                                                                                                              |
|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Start, s_0              | <p>Hi there! I am a bot which is designed to help you prepare for emergencies. I am still in development, but I will try my best to answer your questions.</p> <p>What do you want to know?</p> | <ol style="list-style-type: none"> <li>1. How do the UK emergency services work?</li> <li>2. How to reach emergency services?</li> <li>3. What to say on the phone?</li> </ol> |

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| Route A, s_1     | <p><b>How do the UK emergency services work?</b></p> <p>The UK has 2 kinds of services for immediate treatment. One is called the Accident and Emergency (A&amp;E) department. They deal with life-threatening problems. The other is called the Minor Injuries department. They deal with minor injuries and illnesses. Neither of them is designed to treat long-term problems. You do not need to register or book an appointment to use any of them.</p>                                                                                                                                                                                                                                                                                  | <p>1. What is the Accident and Emergency (A&amp;E) department, and how to use it?</p> <p>2. What is the Minor Injuries department? How to use it?</p> |
| Route A-1, s_2   | <p><b>What is the Accident and Emergency (A&amp;E) department? How to use it?</b></p> <p>The A&amp;E department deals with life-threatening emergencies. For example, loss of consciousness, trauma, breathing difficulties, severe bleeding and burns, or self-harm. They are available 24 hours, 7 days a week. You can either walk into an A&amp;E or call 999 to request an ambulance to take you to the A&amp;E. You can find the list of A&amp;Es here: <a href="https://www.nhsinform.scot/scotlands-service-directory/aes-and-minor-injuries-units">https://www.nhsinform.scot/scotlands-service-directory/aes-and-minor-injuries-units</a>. The A&amp;E are extremely busy, so use it when you think it is absolutely necessary.</p> | <p>1. Do I have to pay for emergency services?</p>                                                                                                    |
| Route A-X-X, s_3 | <p><b>Do I have to pay for emergency services?</b></p> <p>No. All emergency services in the UK are free. For example, attending A&amp;Es, attending minor injury centres, calling for ambulances, and use of medicines, etc.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <p>1. Show me the summary: End of the conversation</p>                                                                                                |
| Route A-2, s_4   | <p><b>What is the Minor Injuries department? How to use it?</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <p>1. Do I have to pay for emergency services (including</p>                                                                                          |

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                          |
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|                | <p>The minor injuries department deals with urgent medical problems that are not life-threatening. For example, bites, cuts, minor burns, broken bones, stomach pain, tooth pain, eye problems, etc. They are available 12 hours a day and 7 days a week. You can walk either “walk-in” into a minor injuries department (available on workdays only), or call 111 to arrange an urgent appointment for you (available on workdays and weekends). You can find the list of Minor Injuries departments here: <a href="https://www.nhsinform.scot/scotlands-service-directory/aes-and-minor-injuries-units">https://www.nhsinform.scot/scotlands-service-directory/aes-and-minor-injuries-units</a>. The Minor Injuries department is the place to go if you need urgent medical attention, but not life-threatening.</p> | Minor injury services)?                                                                                                  |
| Route B, s_5   | <p><b>How to reach emergency services?</b></p> <p>First, assess your problem. If it is life-threatening, call 999; if it is urgent but not life-threatening, call 111; otherwise, contact your GP.</p> <p>If you are not sure whether you are in an emergency or not, just call 111. The staff will ask about your personal information (name, date of birth, address) and then assess your condition. They will guide you to the appropriate service depending on the situation. For example, they will call an ambulance if you are in danger or book an urgent appointment with the minor injuries unit near you.</p>                                                                                                                                                                                                | <p>1. How long to wait at the A&amp;E or the minor injuries department?</p> <p>2. What will happen after I call 111?</p> |
| Route B-1, s_6 | <b>How long to wait at the A&amp;E or the minor injuries department?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 1. What should I do to avoid long waiting times?                                                                         |

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|                  | <p>This depends on the severity of the illness. People with severe conditions will be seen first. If your condition is less severe, it will take up to a few hours. The doctor will pre-assess (预评估) your condition when you arrive at the A&amp;E or the minor injuries department.</p>                                                                                                                                                                                                                                                                                                                                            |                                                             |
| Route B-1-X, s_7 | <p><b>What should I do to avoid long waiting times?</b></p> <p>If you don't know what to do, you should call 111 before walking into the A&amp;E or minor injuries department. They can book an appointment for you. This saves time to register and pre-assess.</p> <p>If your condition is not urgent, you should first use the online self-help guide: <a href="https://www.nhsinform.scot/self-help-guides">https://www.nhsinform.scot/self-help-guides</a> for medical advice. Sometimes, you may not need to go to the minor injuries department as your local pharmacists, dentists or GPs can also help with the issue.</p> | 1. Show me the summary: End of the conversation             |
| Route B-2, s_8   | <p><b>What will happen after I call 111?</b></p> <p>Staff will ask about your personal information (name, date of birth, address) and then assess your condition. Depending on the situation, they will:</p> <ul style="list-style-type: none"> <li>- find out the local service that can help you.</li> <li>- book you with an emergency nurse, dentist or GP (other than your GP).</li> </ul>                                                                                                                                                                                                                                     | 1. What will happen at the A&E and minor injury department? |

|                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                           |
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|                  | <ul style="list-style-type: none"> <li>- book you with the A&amp;E or minor injury department.</li> <li>- arrange an ambulance.</li> <li>- help you to get the medicine you need.</li> <li>- help you speak to someone who can provide mental health support.</li> </ul>                                                                                                                                                                                                                                                           |                                                                                                                                           |
| Route B-2-X, s_9 | <p><b>What will happen at the A&amp;E and minor injury department?</b></p> <p>First, the reception (前台) will ask you about your personal details (name, date of birth, address) to register. Then, you will be pre-assessed by a nurse or doctor (i.e., triage 分诊) to add you to the waiting list. After some time, you will be seen by the emergency or minor injury doctor to carry out examinations and urgent treatments. After that, they will send you home or refer you to the GP or specialists for further treatment.</p> | 1. Show me the summary: End of the conversation                                                                                           |
| Route C, s_10    | <p><b>What to say on the phone?</b></p> <p>The staff will ask you about your name, date of birth, and your location, such as the postcode. They will also ask why you made the call. You will be asked a series of questions about your problem, such as your concern and your feelings. You may also speak to the staff about what you want (e.g., ask them to book a GP appointment in your local area if your GP is closed). This will help them to better understand your situation.</p>                                       | <p>1. I am not confident in English. What should I do?</p> <p>2. What should I prepare to deal with emergencies or urgent situations?</p> |
| Route C-1, s_11  | <b>I am not confident in English. What should I do?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1. Show me the summary: End of the conversation                                                                                           |

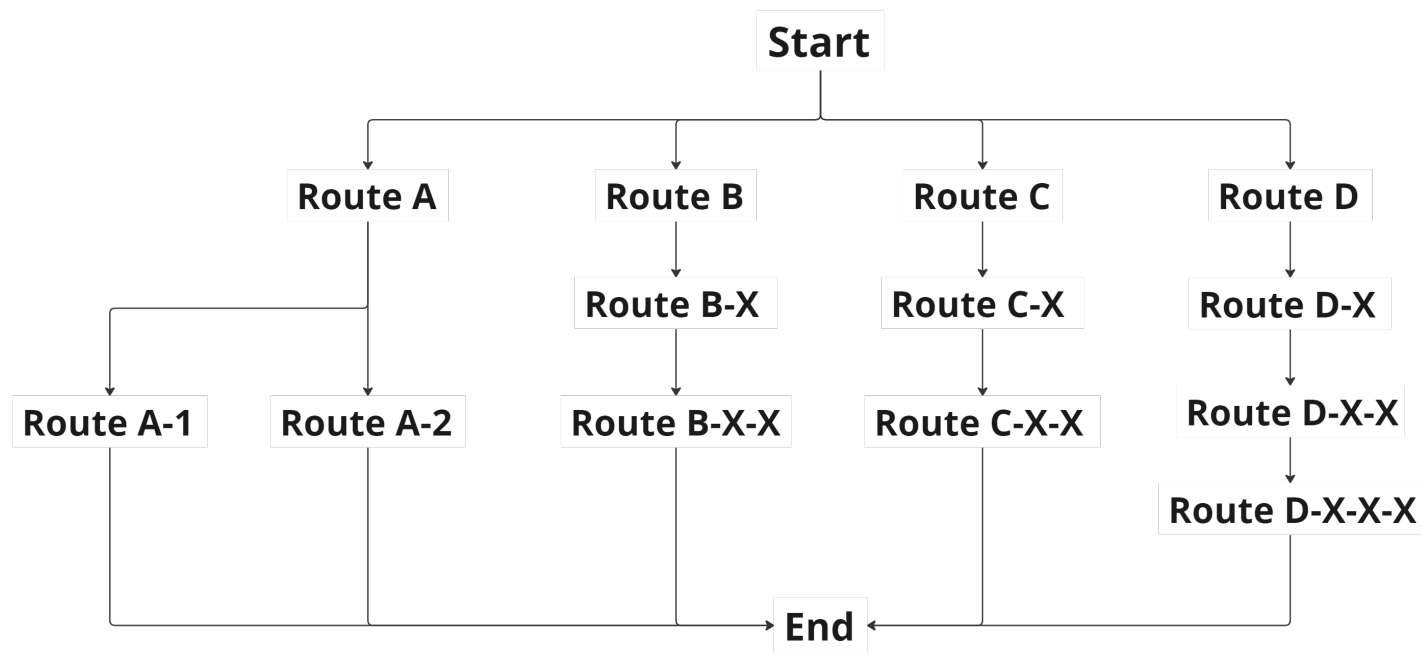
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|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|
|                 | <p>First, don't panic (恐慌). If you don't have time to prepare, the NHS offers interpreter services. Speak to the staff that you need an interpreter in Mandarin (普通话). The staff will arrange for an interpreter to join the call. If you have some time to prepare, you should go through the NHS's self-guides: <a href="https://www.nhsinform.scot/self-help-guides">https://www.nhsinform.scot/self-help-guides</a>, and make sure to look up the terms that you don't know (e.g., using translation apps). When describing your problem, use the statements that were used in the self-guides. Have an idea about the service you need. When talking to the staff, be clear about your needs. For example, speak to the staff who you wish to have a face-to-face appointment, if you cannot handle the problem yourself.</p>                                                                                        |                                                 |
| Route C-2, s_12 | <p><b>What should I prepare to deal with emergencies or urgent situations?</b></p> <p>If you run into a life-threatening problem, the first thing you should do is to call 999. You should also ask people around you for help. Otherwise, you should go to the NHS website: <a href="https://www.nhsinform.scot/self-help-guides">https://www.nhsinform.scot/self-help-guides</a> to understand your symptoms first. Doing so will help you to learn relevant medical concepts, how you will be treated, and clarify your needs when making the call. If the 111 is busy, you may go directly to the minor injuries department: <a href="https://www.nhsinform.scot/scotlands-service-directory/aes-and-minor-injuries-units/">https://www.nhsinform.scot/scotlands-service-directory/aes-and-minor-injuries-units/</a> near you. For slight cuts and burns, you can prepare some bandages and healing gels from the</p> | 1. Show me the summary: End of the conversation |



|           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |     |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
|           | pharmacy. Do not hesitate (犹豫) to ask people around you for help, even strangers.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |     |
| End, s_13 | <p><b>End of the conversation: What to take away?</b></p> <p>There are 2 emergency services in the UK. The 999 deals with life-threatening problems. The 111 deals with non-life-threatening problems that you cannot handle. If you are not sure which one to use, call 111. On the phone, the staff will ask about your personal information (name, date of birth, address) and then ask about your problem. It would be best if you could look up the NHS's self-guides to understand the problem and be clear about what you need. When speaking to the staff, don't panic (恐慌), you can always ask for an interpreter to join the conversation. The staff will direct you to the appropriate service based on the assessment.</p> | N/A |

**Use Case Scenario 4: Handling minor and chronic conditions in the UK, Use of General Practitioners.**

Dialogue Flow:



## Dialogue Content:

| Content_ID,<br>State_ID | Dialogue Content                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Follow-up Options                                                                                                                                                                                                                                      |
|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Start, s_0              | Hi there! I am a bot which is designed to help you use the General Practitioner (GP) to deal with minor health problems. I am still in development, but I will try my best to answer your questions.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <ol style="list-style-type: none"> <li>1. Where to treat minor health problems in the UK?</li> <li>2. How to use the GP if I have a problem?</li> <li>3. What will happen when I phone the GP?</li> <li>4. How to get the most from the GP?</li> </ol> |
| Route A, s_1            | <p><b>Where to treat minor health problems in the UK?</b></p> <p>The General Practice (GP) is the place to go when you have a problem that is not urgent, but you need help. You should register and then book an appointment with a GP before you see the GP. You can find your nearest GP here: <a href="https://www.nhsinform.scot/scotlands-service-directory/gp-practices">https://www.nhsinform.scot/scotlands-service-directory/gp-practices</a>.</p> <p>Sometimes, you have to wait for a few days to be treated. Alternatively, you can go to the pharmacy and ask a pharmacist for help. They are open 6-7 days a week, and no need for appointments. They will give advice or refer you to a GP if you need further checks.</p> | <ol style="list-style-type: none"> <li>1. What is a minor health problem?</li> <li>2. When to use the GP?</li> </ol>                                                                                                                                   |
| Route A-1, s_2          | <p><b>What is a minor health problem?</b></p> <p>Minor problems are problems that slightly or somewhat (一些) affect your daily life but do not need urgent medical attention. This includes short-term problems such as a bad cold,</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <ol style="list-style-type: none"> <li>1. When to use the GP?</li> <li>2. End of the conversation: What to take away?</li> </ol>                                                                                                                       |

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                 |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
|                | continuous cough, or a rash (皮疹). This also includes long-term problems that are already under control but need check-ups, such as asthma (哮喘) or long-term pain. General Practice (GP) is the place to go when you have minor problems. You should register with a GP before you go to the GP.                                                                                                                                                                                                                                                                   |                                                                                                 |
| Route A-2, s_3 | <p><b>When to use the GP?</b></p> <p>You should go to see the GP when you have a minor problem. For example, a cold that doesn't seem to be going away or a pain that keeps coming back. You should see the GP when you are worried about an emerging condition. You should also see the GP if you have a long-term condition so that they can keep you under control.</p> <p>If you have mental or sexual health questions, you should also go to see the GP. For example, having a low mood which affects your daily routine or having unusual period pain.</p> | <p>1. What is a minor health problem?</p> <p>2. End of the conversation: What to take away?</p> |
| Route B, s_4   | <p><b>How to use the GP if I have a problem?</b></p> <p>Look at the GP's website that you registered to find out their opening hours and contact details. You can book an appointment during working hours by calling them. Some GPs can also be booked online. It is important to look at their website to see how your particular GP works, as GPs work differently in terms of how you book with them.</p>                                                                                                                                                     | <p>1. How long do I have to wait to see a doctor?</p>                                           |

|                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                |
|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|
|                  | <p>If you want to see a GP outside working hours, you should phone 111 and ask them to arrange an urgent GP consultation in your local area. More information about GP appointments can be found here: <a href="https://www.nhs.uk/nhs-services/gps/gp-appointments-and-bookings/">https://www.nhs.uk/nhs-services/gps/gp-appointments-and-bookings/</a>.</p>                                                                                                                                                                                                          |                                                |
| Route B-X, s_5   | <p><b>How long do I have to wait to see a doctor?</b></p> <p>This depends on whether or not the GP is busy. For example, GPs are usually busy at the start of the semester as they are processing a lot of registrations. This also depends on the severity of your problem. If the problem is urgent, you will be seen quickly (within 1 or 2 days).</p> <p>It is normal to wait for a few days to be seen, but you need to wait longer if you have special needs, such as if you want to see a specific doctor or you want to see the doctor at a specific time.</p> | 1. Private GPs and costs                       |
| Route B-X-X, s_6 | <p><b>Private GPs and costs</b></p> <p>If you have a minor problem that is so annoying that you cannot wait, you can go look for a private GP. You don't need to register with them, and you will usually be seen on the same booking day. The private GP can refer you to NHS specialists quickly, as you don't have to wait for a GP referral. You have to pay for the private GP visit, but you don't need to pay for the specialists if you ask them to refer you to the NHS service.</p>                                                                          | 1. End of the conversation: What to take away? |
| Route C, s_7     | <p><b>What will happen when I phone the GP?</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 1. What will happen when I arrive at the GP?   |

|                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                |
|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|
|                  | <p>First, the receptionist (前台) will ask about your problem. You should describe the symptom (e.g., pain, a cold), how severe it is (e.g., it lasts for a few days, very painful), and how you dealt with it. This helps them to allocate a doctor who suits you. Then, they will ask about your personal information such as your name, date of birth and where you live. You should also tell them about your needs. For example, you'd like to see a doctor at a particular time, or you want a particular doctor, like a doctor who has seen you before, or a male or female doctor.</p> |                                                |
| Route C-X, s_8   | <p><b>What will happen when I arrive at the GP?</b></p> <p>First, the receptionist will notify the doctor. Then, you will be invited to the consultation room. The doctor will ask about your symptoms and how severe it is. Then, they will do some simple checks to assess your condition (e.g., check your body temperature). Do not expect them to carry out complex examinations such as CT scans, as these are carried out by specialists. The consultation normally lasts for 10 minutes.</p>                                                                                         | 1. What will happen after I see the GP?        |
| Route C-X-X, s_9 | <p><b>What will happen after I see the GP?</b></p> <p>After the initial assessment, if the doctor thinks that your condition is minor and will go away itself, they will tell you that you don't have to worry. If you are uncomfortable, they will advise you to take painkillers (止痛药). If the doctor thinks that your condition needs treatment, they will ask you to follow the</p>                                                                                                                                                                                                      | 1. End of the conversation: What to take away? |

|                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                     |
|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|
|                 | instructions to take prescribed medicines (处方药), e.g., antibiotics. If the doctor thinks that your condition needs further assessment, they will refer you to other services, such as hospital specialists.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                     |
| Route D, s_10   | <p><b>How to get the most from the GP?</b></p> <p>First, understand your problem. You can do this by looking up the self-diagnosis sections on the NHS website: <a href="https://www.nhsinform.scot/symptoms-and-self-help/self-help-guides">https://www.nhsinform.scot/symptoms-and-self-help/self-help-guides</a>. While you are reading, pay attention to the medical concepts that you don't know. Translate and take note of them, as they may appear during the consultation.</p> <p>Second, write down your symptoms. This includes the symptom (e.g., pain, a cold), how severe it is, and things you have tried to deal with it (e.g., taking Traditional Chinese Medicine).</p> <p>Third, think about questions to ask. For example, what are you worrying about? What test do I need? What is the treatment? How long will I need to wait? It is also useful to think about what you want to get from the GP, a particular test or medicine.</p> | 1. How to discuss with the GP about my problems?    |
| Route D-X, s_11 | <p><b>How to discuss with the GP about my problems?</b></p> <p>First, describe your problem. Tell the doctor about your symptoms, when they started, and what makes them better or worse.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 1. What if the doctor does not give me what I want? |

|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                     |
|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|
|                   | <p>After the initial assessment, you will have an idea about the treatment. However, it is your responsibility to make sure that the treatment fits you. Ask the doctor questions like:</p> <ul style="list-style-type: none"> <li>- Are there any side effects of the prescribed medicine?</li> <li>- How long do I have to wait for further checks?</li> <li>- How effective is this treatment?</li> </ul> <p>You should ask the doctor to change to another treatment if you are unhappy with it.</p> |                                                     |
| Route D-X-X, s_12 | <p><b>What if the doctor does not give me what I want?</b></p> <p>Sometimes, the doctor may misunderstand your problem. When this happens, you should be clear about your needs and reasons to have them. You should tell the doctor what you think about the problem and the kind of impact on you if you are not having them. If the doctor still disagrees with you, you should consider seeing another doctor, or even a doctor from private practice.</p>                                           | 1. I am not confident in English. What should I do? |
| Route D-X-X, s_13 | <p><b>I am not confident in English. What should I do?</b></p> <p>Don't panic (恐慌). Don't worry about running overtime. If any words that you don't know come up in the conversation, you can ask the doctor to explain them or ask the doctor to write them down, and then look them up in the translation app. It is the doctor's job to make sure that you understand what they are saying. Some GPs also have interpreters. Ask the receptionist (前</p>                                              | 1. End of the conversation: What to take away?      |



|           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |     |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
|           | 台) if you want one when you book the appointment. Some GPs even have doctors who speak Chinese. You can ask the receptionist to book an appointment with them.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |     |
| End, s_14 | <p><b>End of the conversation: What to take away?</b></p> <p>The General Practice (GP) is the place to go when you have a problem that is not urgent. Phone them to arrange an appointment. You will wait a few days to be seen, and it also depends on the severity of the problem. Private ones are quicker, but you have to pay for them. Before visiting the GP, make sure you understand the problem and are clear about your needs. When at the GP, describe your problem as well as things that make you worried. Ask the doctor to change to another treatment if you are unhappy with the doctor's proposal (提议). If you encounter something that you don't know, use a translation app or ask the doctor to explain it until you understand it.</p> | N/A |

## **Appendix E: Study Materials for Chatbot Implementation**

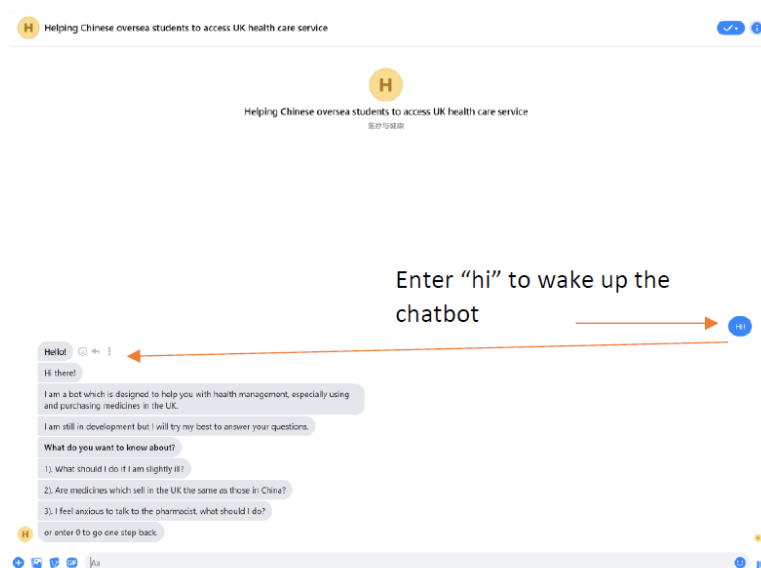
This appendix documents the materials which we used to evaluate the chatbot prototype in Chapter 8. Appendix E1 documents user instructions on how to interact with the chatbot under the experiment setting. The WoZ experiment is a mixed study experiment which includes quantitative data (questionnaires) and qualitative data (semi-structured interviews). Appendix E2 documents the Healthcare Service Utilisation Questionnaire that we used to measure the willingness to utilise healthcare services before and after the user interacts with the chatbot. Appendix E3 documents the adapted Subjective Assessment of Speech System Interfaces (SASSI) questionnaire. SASSI is a standardised questionnaire that measures users' subjective experiences and their perceived usability of dialogue systems. We changed some terms in the original questionnaire to fit the context of the WoZ experiment. Appendix E5 documents the deductive codebook which we used to analyse the post-experiment interview transcripts. Appendix E6 summarises the open questions that participants asked the chatbot in WoZ experiments.

## E1: User Instructions on How to Interact with the Chatbot Prototype

### How to interact with the chatbot

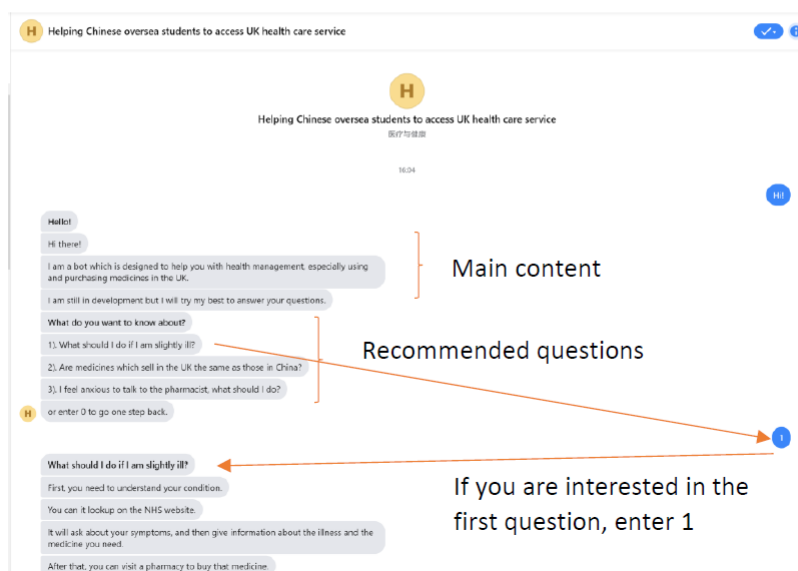
Thanks again for your participation. In this experiment, you will be asked to interact with a chatbot. Here are the steps to interact with it:

1. At the start of the session, you need to enter “hi” or “hello” to wake up the bot. After that, the bot will respond to your message and introduce itself.

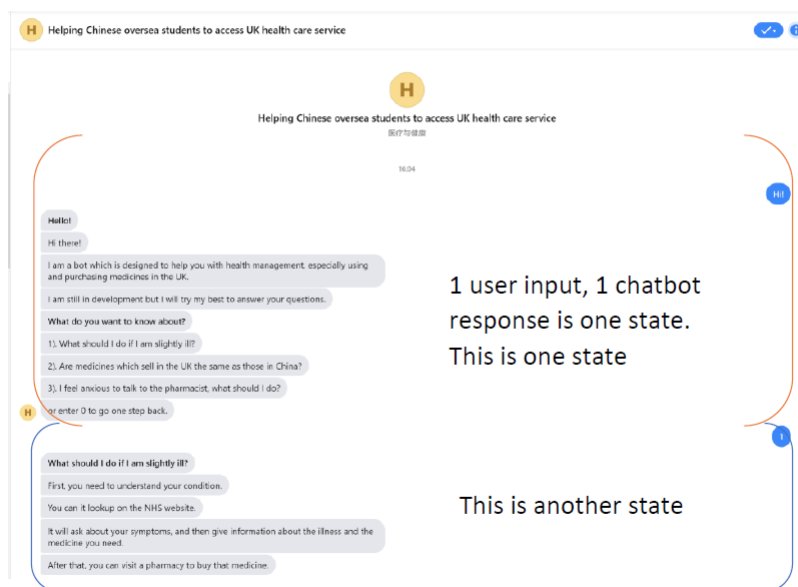


2. While you are chatting, you can follow the recommended questions under “**what do you want to know about?**” or “**what do you want to know next?**” to explore the content.

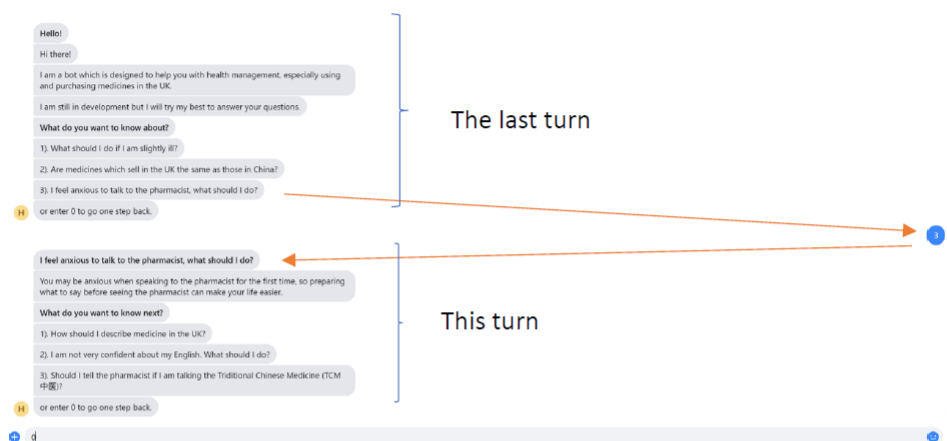
To do this, enter the sequence number in front of the question that you want to ask. Then, the chatbot will respond to your input.



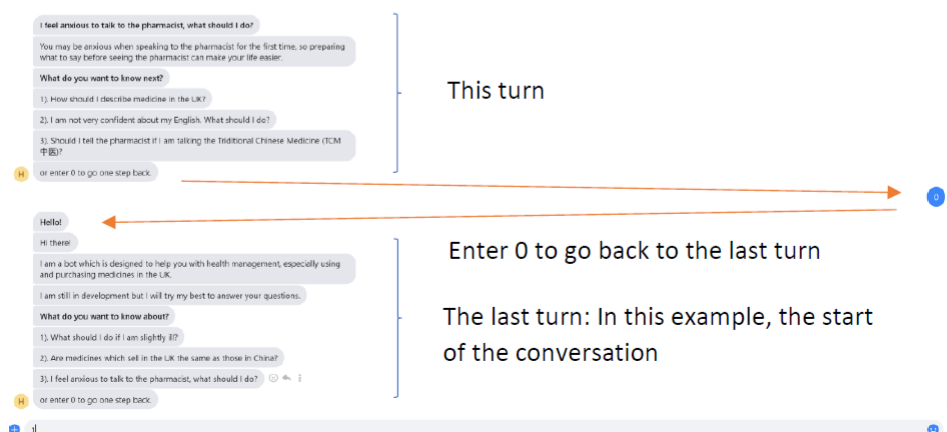
We define 1 user input and 1 chatbot response as one turn. The chatbot is a turn-based system.



3. If you are interested in more than one question, you can always choose one question first and then go back to this turn later. For example, you are interested in the question “How should I describe medicine in the UK?” and “I feel anxious to talk to the pharmacist, what should I do?”. You can enter 3 to explore “I feel anxious to talk to the pharmacist, what should I do?” first, and then press 0 to go one step back (image 1), i.e., go to the last turn.



Enter 0 will allow you to go to the last turn. In this example, one-turn back is the start of the conversation (image 2). Now, you can explore the other question that you are interested in i.e., “How should I describe medicine in the UK?” by pressing 1 (image 3).



What do you want to know about?

1. What should I do if I am slightly ill?  
 2. Are medicines which sell in the UK the same as those in China?  
 3. I feel anxious to talk to the pharmacist, what should I do?  
 or enter 0 to go one step back.

What should I do if I am slightly ill?

- First, you need to understand your condition.  
 You can look it up on the NHS website.  
 It will ask about your symptoms, and then give information about the illness and the medicine you need.  
 - After that, you can visit a pharmacy to buy that medicine.  
 - If you are still not sure, ask a pharmacist.  
 The pharmacist can give you medical advice beyond recommendations on medicines.  
 You don't need any appointments to see a pharmacist.

What do you want to know next?

1. How the pharmacy can help if I am slightly ill?  
 2. Where should I look up to understand my condition?  
 or enter 0 to go one step back.

The question that you want to explore comes back (question 1)

Now, you can press 1 to explore

4. Some messages will contain hyperlinks. Please feel free to click on the link to learn more. There is no time limit on your reading time. The link will direct you to another webpage (opens a new browser tab). Once you finished reading the page, close it and proceed with the conversation.

Where should I look up to understand my condition?

The NHS website has a wide range of information including symptom diagnosis and medicines to use.  
 It is important to look up information from trustable sources as results from search engines can be misleading.  
 More information about symptom diagnosis can be found here: <https://www.nhsinform.scot/symptoms-and-self-help/>, and more information about medicines can be found here: <https://www.nhs.uk/medicines/>.

What do you want to know next?

1. Show me the summary - end the conversation  
 or enter 0 to go one step back.

Click them to learn more

5. If you choose to end the conversation, the chatbot will show a summary (image 1).

What do you want to know next?

1. How to buy restricted or prescribed medicines in the UK?  
 2. Show me the summary - end of the conversation  
 or enter 0 to go one step back.

End of the conversation: What to take away?

If you feel slightly or somewhat ill, the first step is to understand the condition.  
 You can look up the NHS's website for information about symptom diagnosis and treatments.  
 Visiting the pharmacy is the quickest way to get in touch with the NHS.  
 Pharmacists will assess your condition and give medical advice and refer you to other services if needed.  
 When talking to pharmacists, don't be anxious.  
 It is a good idea to speak about all your symptoms and your concerns.  
 In this way, the pharmacist can assess your condition completely.

This is the end of the conversation, you can:

1. go back to the start of the conversation,  
 or enter 0 to go one step back,  
 or type your question below if you have an extra question.

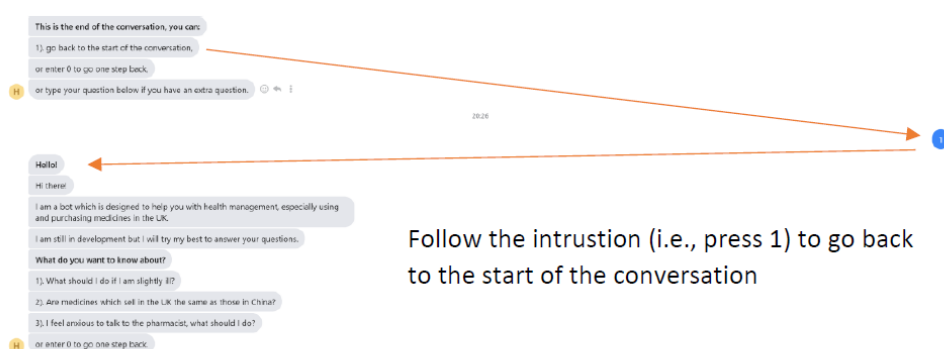
The chatbot will show a summary if you choose to end the conversation

Press 2 in this example

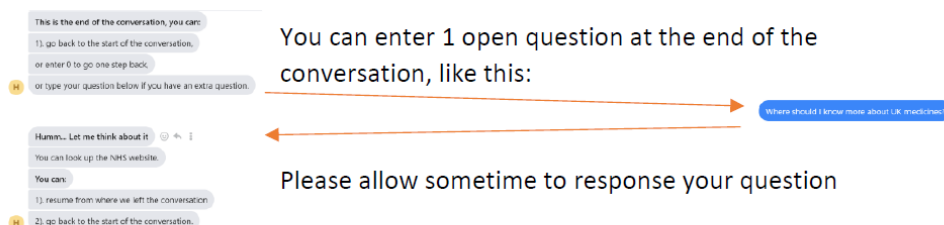
After that, you can:

- a) Go back to the start of the conversation – if you left something which you haven't picked and you want to explore more about them.
- b) Ask one question in free text form. The chatbot will attempt to answer the question, but it does not guarantee to give you a satisfactory answer.
- c) End the conversation. Once you think you have finished exploring the information, enter "I'd like to end the conversation". This will deactivate the chatbot. The chatbot will not respond to your messages further.

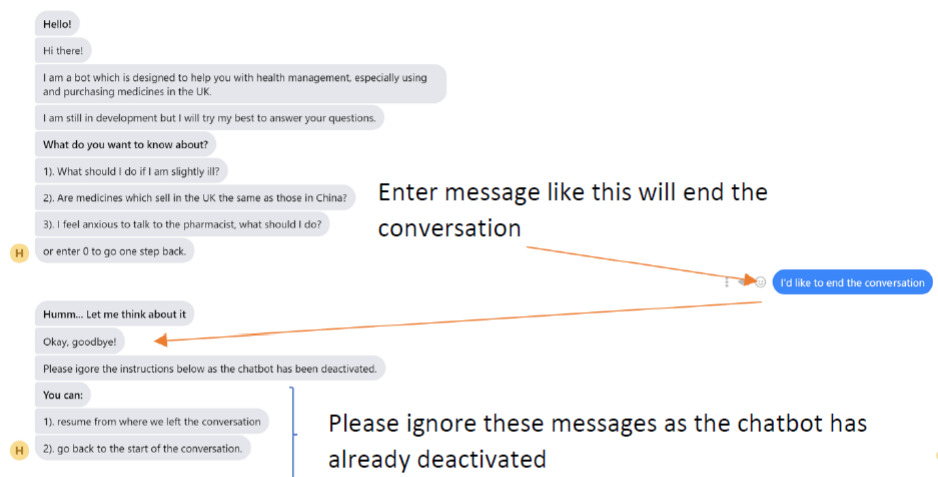
- a) Go back to the start of the conversation.



- b) Ask one question in free text form.



- c) If you want to end the conversation. Enter something like “Bye” or “End the conversation”. The chatbot will then deactivates, and it will not respond to any other messages. Do not enter any other messages after that.



### Things to note:

The chatbot needs time to process your input. It usually takes 1 to 2 seconds to respond to numbered inputs, and it takes more time to process free-input messages. It usually takes around 10 seconds to respond to free-input messages. The processing time is dependent on the complexity of your free-input questions. While the chatbot is processing a message, do not enter any other messages as it can break the chatbot.



## E2: Developed Healthcare Service Utilisation Questionnaire

Participant ID: \_\_\_\_\_

Date: \_\_\_\_\_

Pre/Post: \_\_\_\_\_

### The health care accessibility questionnaire: Introduction

This questionnaire is part of an experiment to investigate Chinese overseas students' willingness to use health care services in the UK. In this questionnaire, we are interested in your opinions about using health care services in the UK when you are ill.

We define **the UK health care services** as all health care services that you can use in the UK, such as general practitioners (GP), pharmacies (药店), opticians (验光师), dentists (牙医), emergency departments, specialist doctors, hospitals, or mental health counselling services (心理咨询).

We define **ill** as any physical illness or mental discomforts that you may have, for example, cold, cough, stomach ache, period pain (痛经), back pain, influenza (流感), burns, broken bones, anxiety (焦虑), depression (抑郁), etc.

We define **slightly ill** as conditions that only slightly affect your daily life. This means that you can still do most or all of your daily tasks, but you don't feel well. Example: a slight cough, a small cold.

We define **somewhat** as conditions that somewhat affect your daily life. This means that you need to limit the tasks that you can do, or that you will have a hard time doing so. Example: a bad cold.

We define **very ill** as conditions that will significantly affect your daily life. This means that you cannot perform most of the daily tasks, such as cooking and studying. Example: Acute appendicitis, severe burns, severe influenza (严重流感).

Please read each question carefully. There are no right or wrong responses. We are only interested in your point of view.

### How to answer the questionnaire?

All questions in this questionnaire are in the form of statements and a 7-point agreement-disagreement scale. You are asked to tick (✓) the box that best describes your opinion, i.e., to agree or disagree with a statement.

For example, the statement "I like cats." and its 7-point scale looks like this:

I like cats.

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | Disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

Participant ID:

Date:

Pre/Post:

If you like cats very much, you should tick the box “Strongly agree”.

|                   |          |                   |         |                |       |                     |
|-------------------|----------|-------------------|---------|----------------|-------|---------------------|
| Strongly disagree | Disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree<br>✓ |
|-------------------|----------|-------------------|---------|----------------|-------|---------------------|

If you like cats in general, you should tick the box under “Agree”.

|                   |          |                   |         |                |            |                |
|-------------------|----------|-------------------|---------|----------------|------------|----------------|
| Strongly disagree | Disagree | Somewhat disagree | Neutral | Somewhat agree | Agree<br>✓ | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|------------|----------------|

If you somewhat feel good about cats, you should tick the box under “Somewhat agree”.

|                   |          |                   |         |                     |       |                |
|-------------------|----------|-------------------|---------|---------------------|-------|----------------|
| Strongly disagree | Disagree | Somewhat disagree | Neutral | Somewhat agree<br>✓ | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|---------------------|-------|----------------|

If you don’t have an opinion on liking or disliking cats (e.g., you don’t know or you are not sure), you should tick the box under “Neutral”.

|                   |          |                   |              |                |       |                |
|-------------------|----------|-------------------|--------------|----------------|-------|----------------|
| Strongly disagree | Disagree | Somewhat disagree | Neutral<br>✓ | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|--------------|----------------|-------|----------------|

If you somewhat feel bad about cats, you should tick the box under “Somewhat disagree”.

|                   |          |                        |         |                |       |                |
|-------------------|----------|------------------------|---------|----------------|-------|----------------|
| Strongly disagree | Disagree | Somewhat disagree<br>✓ | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|------------------------|---------|----------------|-------|----------------|

if you dislike cats, you should tick the box under “Disagree”.

|                   |               |                   |         |                |       |                |
|-------------------|---------------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | Disagree<br>✓ | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|---------------|-------------------|---------|----------------|-------|----------------|

if you dislike cats very much, you should tick the box under “Strongly disagree”.

|                        |          |                   |         |                |       |                |
|------------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree<br>✓ | Disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|------------------------|----------|-------------------|---------|----------------|-------|----------------|

When you are answering the questionnaire, please remember the following points:

1. This questionnaire has 44 questions. Please try your best to answer all of the questions.
2. Do not tick (✓) more than one box for each question.

Participant ID:

Date:

Pre/Post:

**Section 1: To what extent do you agree or disagree with the following statements?****1.1 I intend to use UK health care services for help:**

If I feel slightly ill (e.g., a slight cough or a small cold).

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

If I feel somewhat ill (e.g., a bad cold).

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

If I feel very ill (e.g., emergencies, severe influenza 严重流感).

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

**1.2 When I feel ill in the UK, my first reaction is to use relevant UK health care services.**

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

**1.3 When I feel ill in the UK, my first reaction is to solve the problem myself with remedies (药物或治疗措施) that I already know.**

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

Participant ID:

Date:

Pre/Post:

**Section 2: How do you feel about health care services in the UK?**

On each scale, tick (✓) the box that best describes your feeling.

|                       |         |                  |         |                  |         |                       |
|-----------------------|---------|------------------|---------|------------------|---------|-----------------------|
| Very useless<br>非常无用的 | Useless | Somewhat useless | Neutral | Somewhat helpful | Helpful | Very helpful<br>非常有用的 |
|-----------------------|---------|------------------|---------|------------------|---------|-----------------------|

|                  |     |              |         |               |      |                   |
|------------------|-----|--------------|---------|---------------|------|-------------------|
| Very bad<br>非常坏的 | Bad | Somewhat bad | Neutral | Somewhat good | Good | Very good<br>非常好的 |
|------------------|-----|--------------|---------|---------------|------|-------------------|

|                                |                  |                              |         |                         |             |                           |
|--------------------------------|------------------|------------------------------|---------|-------------------------|-------------|---------------------------|
| Very difficult to use<br>非常困难的 | Difficult to use | Somewhat difficult<br>to use | Neutral | Somewhat easy to<br>use | Easy to use | Very easy to use<br>非常简单的 |
|--------------------------------|------------------|------------------------------|---------|-------------------------|-------------|---------------------------|

**Section 3: to what extent do you agree or disagree with the following statements?****3.1 People who live in the UK (i.e., the general population) would expect me to use UK health care services for help:**

If I feel slightly ill (e.g., a slight cough or a small cold).

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

If I feel somewhat ill (e.g., a bad cold).

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

If I feel very ill (e.g., emergencies, severe influenza 严重流感).

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

Participant ID:

Date:

Pre/Post:

### 3.2 Other Chinese students in the UK would expect me to use UK health care services for help:

If I feel slightly ill (e.g., a slight cough or a small cold).

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

If I feel somewhat ill (e.g., a bad cold).

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

If I feel very ill (e.g., emergencies, severe influenza 严重流感).

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

### 3.3 Friends and family in China would expect me to use UK health care services for help:

If I feel slightly ill (e.g., a slight cough or a small cold).

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

If I feel somewhat ill (e.g., a bad cold).

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

If I feel very ill (e.g., emergencies, severe influenza 严重流感).

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

Participant ID:

Date:

Pre/Post:

**3.4 Based on your experience, people who live in the UK (i.e., the general population) would use UK health care services for help:**

If they feel slightly ill (e.g., a slight cough or a small cold).

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

If they feel somewhat ill (e.g., a bad cold).

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

If they feel very ill (e.g., emergencies, severe influenza 严重流感).

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

**3.5 Based on your experience, international students in the UK, who are not Chinese, use UK health care services for help:**

If they feel slightly ill (e.g., a slight cough or a small cold).

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

If they feel somewhat ill (e.g., a bad cold).

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

If they feel very ill (e.g., emergencies, severe influenza 严重流感).

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

Participant ID:

Date:

Pre/Post:

### 3.6 Based on your experience, other Chinese students in the UK use UK health care services for help:

If they feel slightly ill (e.g., a slight cough or a small cold).

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

If they feel somewhat ill (e.g., a bad cold).

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

If they feel very ill (e.g., emergencies, severe influenza 严重流感).

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

### 3.7 Based on your experience, friends and family in China use health care services (中国的医疗系统) for help:

If they feel slightly ill (e.g., a slight cough or a small cold).

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

If they feel somewhat ill (e.g., a bad cold).

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

If they feel very ill (e.g., emergencies, severe influenza 严重流感).

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

Participant ID:

Date:

Pre/Post:

**Section 4: To what extent do you agree or disagree with the following statements?****4.1 If I use relevant UK health care services when I am ill:**

I am confident that I can communicate my needs.

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

I can identify the services that will give me the right care.

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

I am familiar with the care process. I know what to do next to solve the problem.

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

I know where to look up things that I don't know.

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

**4.2 When deciding whether or not to use UK health care services:**

I decide only based on the state of my health (健康状况).

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

I have to worry about non-health-related things (e.g., time constraints, study, work, money, or student life).

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|



Participant ID:

Date:

Pre/Post:

**Section 5: To what extent do you agree or disagree with the following statements?****5.1 Using the UK health care system will resolve (解决) my health problems.**

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

**5.2 Thinking of using the UK health care system is stressful.**

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

**5.3 Using the UK health care system will need a lot of time and effort from me.**

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

**5.4 When using UK health care services, it is the doctor's responsibility to look after (照顾) me.**

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

**5.5 When using UK health care services, the doctor will take me seriously.**

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

**5.6 When using UK health care services, I will never openly disagree with doctors' advice.**

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

**5.7 When using UK health care services, I know how they work and what I can expect from them.**

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

**5.8 When thinking of using UK health care services, I know how to use Western Medicine concepts (西医概念) to discuss my problems instead of Chinese Traditional Medicine concepts (e.g., (中医概念, 上火, 水土不服))**

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

Participant ID: \_\_\_\_\_ Date: \_\_\_\_\_ Pre/Post: \_\_\_\_\_

## E3: Adapted Subjective Assessment of Speech System Interfaces (SASSI) Questionnaire

Participant ID: \_\_\_\_\_

Date: \_\_\_\_\_

Scenario: \_\_\_\_\_

### Accessing chatbot's usability questionnaire: Introduction

This questionnaire is part of an experiment to investigate Chinese overseas students' willingness to use health care services in the UK. In this questionnaire, we are interested in your experience with the chatbot that you have interacted with.

We refer to **the chatbot** as the chatbot (i.e., the Facebook Messenger chatbot) you have just interacted with in the experiment.

Please read each question carefully. There are no right or wrong responses; we are only interested in your personal point of view.

### How to answer the questionnaire?

All questions in this questionnaire are in the form of statements and a 7-point agreement-disagreement scale. You are asked to tick (✓) the box that best describes your opinion, i.e., to agree or disagree with a statement.

For example, the statement "I like cats." and its 7-point scale looks like this:

I like cats.

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | Disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

Participant ID:

Date:

Scenario:

If you like cats very much, you should tick the box “Strongly agree”.

|                   |          |                   |         |                |       |                     |
|-------------------|----------|-------------------|---------|----------------|-------|---------------------|
| Strongly disagree | Disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree<br>✓ |
|-------------------|----------|-------------------|---------|----------------|-------|---------------------|

If you like cats in general, you should tick the box under “Agree”.

|                   |          |                   |         |                |            |                |
|-------------------|----------|-------------------|---------|----------------|------------|----------------|
| Strongly disagree | Disagree | Somewhat disagree | Neutral | Somewhat agree | Agree<br>✓ | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|------------|----------------|

If you somewhat feel good about cats, you should tick the box under “Somewhat agree”.

|                   |          |                   |         |                     |       |                |
|-------------------|----------|-------------------|---------|---------------------|-------|----------------|
| Strongly disagree | Disagree | Somewhat disagree | Neutral | Somewhat agree<br>✓ | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|---------------------|-------|----------------|

If you don’t have an opinion on liking or disliking cats (e.g., you don’t know), you should tick the box under “Neutral”.

|                   |          |                   |              |                |       |                |
|-------------------|----------|-------------------|--------------|----------------|-------|----------------|
| Strongly disagree | Disagree | Somewhat disagree | Neutral<br>✓ | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|--------------|----------------|-------|----------------|

If you somewhat feel bad about cats, you should tick the box under “Somewhat disagree”.

|                   |          |                        |         |                |       |                |
|-------------------|----------|------------------------|---------|----------------|-------|----------------|
| Strongly disagree | Disagree | Somewhat disagree<br>✓ | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|------------------------|---------|----------------|-------|----------------|

if you dislike cats, you should tick the box under “Disagree”.

|                   |               |                   |         |                |       |                |
|-------------------|---------------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | Disagree<br>✓ | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|---------------|-------------------|---------|----------------|-------|----------------|

if you dislike cats very much, you should tick the box under “Strongly disagree”.

|                        |          |                   |         |                |       |                |
|------------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree<br>✓ | Disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|------------------------|----------|-------------------|---------|----------------|-------|----------------|

When you are answering the questionnaire, please remember the following points:

1. This questionnaire has 34 questions. Please try your best to answer all of the questions.
2. Do not tick (✓) more than one box for each question.

Participant ID:

Date:

Scenario:

To what extent do you agree or disagree with the following statements?

1. The chatbot is accurate.

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | Disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

2. The chatbot is unreliable.

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | Disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

3. The interaction with the chatbot is unpredictable (无法预测的).

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | Disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

4. The chatbot didn’t always do what I wanted.

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | Disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

5. The chatbot didn’t always do what I expected.

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | Disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

6. The chatbot is dependable (可靠的).

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | Disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

7. The chatbot makes few errors (很少出错).

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | Disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

8. The interaction with the chatbot is consistent (操作是一致的).

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | Disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

Participant ID: \_\_\_\_\_ Date: \_\_\_\_\_ Scenario: \_\_\_\_\_

9. The interaction with the chatbot is efficient (高效的).

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | Disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

10. The chatbot is useful.

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | Disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

11. The chatbot is pleasant (令人愉快的).

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | Disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

12. The chatbot is friendly.

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | Disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

13. I was able to recover easily from errors.

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | Disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

14. I enjoyed using the chatbot.

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | Disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

15. It is clear how to speak to the chatbot.

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | Disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

16. It is easy to learn to use the chatbot.

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | Disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

Participant ID: \_\_\_\_\_ Date: \_\_\_\_\_ Scenario: \_\_\_\_\_

17. I would use (想要使用) this chatbot.

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | Disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

18. I felt in control (可以控制) of the interaction with the chatbot.

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | Disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

19. I felt confident using the chatbot.

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | Disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

20. I felt tense (紧绷的) using the chatbot.

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | Disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

21. I felt calm (平静的) using the chatbot.

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | Disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

22. A high level of concentration (全神贯注) is required when using the chatbot.

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | Disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

23. The chatbot is easy to use.

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | Disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

24. The interaction with the chatbot is repetitive.

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | Disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

Participant ID:

Date:

Scenario:

**25. The interaction with the chatbot is boring.**

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | Disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

**26. The interaction with the chatbot is irritating (令人厌烦的).**

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | Disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

**27. The interaction with the chatbot is frustrating (受挫的).**

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | Disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

**28. The chatbot is too inflexible (呆板).**

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | Disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

**29. I sometimes wondered if I was using the right word (担心我是否用对了正确的词句).**

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | Disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

**30. I always knew what to say to the chatbot.**

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | Disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

**31. I was not always sure what the chatbot was doing.**

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | Disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

**32. It is easy to lose track of where you are in an interaction with the chatbot.**

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | Disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|



Participant ID: \_\_\_\_\_ Date: \_\_\_\_\_ Scenario: \_\_\_\_\_

33. The interaction with the chatbot is fast.

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | Disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

34. The chatbot responds too slowly.

|                   |          |                   |         |                |       |                |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|
| Strongly disagree | Disagree | Somewhat disagree | Neutral | Somewhat agree | Agree | Strongly agree |
|-------------------|----------|-------------------|---------|----------------|-------|----------------|

## E4: Interview Schedule for the Post-experiment Semi-structured Interviews

|                                                                                |
|--------------------------------------------------------------------------------|
| S1: UK healthcare system introduction, what are the services and how they work |
| S2: Self-management, purchase and use of medicines in the UK                   |
| S3: Preparing for urgent conditions and emergencies                            |
| S4: Using the GP to deal with minor health problems                            |

- **Why you picked these two scenarios? Tell me a bit more about it.**
- (For each scenario picked) Recall the conversations
  - **For scenario X, what do you remember about the conversations with the chatbot? Anything impressive?**
  - Prompts:
    - How do you feel about the interaction with the chatbot? Was there anything you particularly liked or disliked? (Overall impression)
    - Do you feel you learned anything new or interesting? If yes, what was it? (e.g., Reducing perceived difficulties or change in attitudes)
- (For each scenario picked) Elicit about perceived difficulties
  - **Let's talk more about the healthcare questionnaires. For scenario X, comparing pre- and post-answers, what has changed?**
  - Prompts:
    - After interacting with the chatbot, how confident are you when talking to a doctor? Why?
    - After interacting with the chatbot, how confident are you about registering a GP? (S1 only)
    - After interacting with the chatbot, how confident are you when you deal with minor problems (S4 only) or an emergency (S3 only)? why?
- (For each scenario picked) Elicit about attitudes about the UK health care system
  - **For scenario X, after interacting with the chatbot, what have you learned about the UK healthcare system?**

- **To what extent has your attitude towards using the UK healthcare system changed, if at all? Why?**
- Prompts:
  - How is the UK health system different from China? (S1)
  - What do you think of the GP's role in managing your health? (S1, S4)
  - What is your role in managing your health in the UK system?
- Elicit about the chatbot medium.
  - **To what extent did you find the conversations helpful? Or to what extent did the conversation feel confusing?**
  - **Would you use the system again, especially in comparison to a helpline or a website such as NHS Inform (the NHS website)?**
- Elicit about improvements
  - **How can we make the chatbot better? Why?**
  - Prompts:
    - Any additional scenarios or features that you want to have?
- Final reflections
  - **When having health problems, do you prefer to overcome health problems by yourself or to seek help from the NHS? Why?**
- After disclosure:
  - **Can you say that this wasn't a real chatbot? If yes, why?**

## E5: Codebook for Semi-structured Interviews

| Category 1: Intentions and changes in intentions to use UK healthcare services                       | Descriptions                                                                                                                                                                                 |
|------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Willingness to engage or disengage with UK healthcare services (before interacting with the chatbot) | Participants' likelihood to use UK healthcare services before interacting with the chatbot and their explanations.                                                                           |
| Changes in intentions to engage with the UK healthcare service (after interacting with the chatbot)  | Statements about changes in the behaviour of using the UK healthcare services after interacting with the chatbot and their explanations (can be more positive or negative, or stay neutral). |

| Category 2: Perceived difficulties and changes in perceptions                            | Descriptions                                                                                                                                    |
|------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| Difficulties with language and communication                                             | Statements about any perceived difficulties around language and communication when talking to healthcare workers.                               |
| Difficulties with accessing/using primary care services                                  | Statements about any perceived difficulties around engaging/using/accessing GPs (for treating minor problems) or pharmacies (buying medicines). |
| Difficulties under urgent situations                                                     | Statements about any perceived difficulties that they might have in an urgent injury or an emergency.                                           |
| Things that they have learned from the chatbot conversation (perception of difficulties) | Information that the participant has learned after talking to the chatbot regarding dealing with difficult situations.                          |
| Confidence and changes in confidence to deal with problems                               | Statements about emotions, or changes in emotions when facing a problem.                                                                        |

| Category 3: Attitude towards the UK healthcare system or changes in attitude | Descriptions                                                                                                            |
|------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|
| Impressions about the UK healthcare services and changes in impressions      | Impressions towards the UK healthcare services, e.g., useful, useless, hard to use, unfamiliar with it, how it compares |

|                                                                                    |                                                                                                                                                         |
|------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                    | to the Chinese system, etc. and if there are any changes in impressions before and after the interaction.                                               |
| Things that they have learned from the chatbot conversation (changes in attitudes) | Information that the participant has learned after talking to the chatbot regarding feelings towards UK healthcare services and changes in feelings.    |
| Thoughts on pharmacists and how they can help                                      | Impression towards pharmacy and pharmacists and their usefulness to help, and if there are any changes in impressions before and after the interaction. |
| Thoughts on GPs and how they can help change                                       | Impression towards GPs and their usefulness to help, and if there are any changes in impressions before and after the interaction.                      |
| Thoughts on UK emergency services and how they can help                            | Impression towards 999 and 111, and their usefulness to help, and if there are any changes in impressions before and after the interaction.             |
| Thoughts on their roles in using UK healthcare services                            | Comments about the role of patients/themselves in the UK healthcare system. What they should do and how it differs from the Chinese system.             |

| Category 4: The chatbot experience                                                  | Descriptions                                                                                                                                                                                                                                                                 |
|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Willingness to accept or use the chatbot (usefulness to access healthcare services) | Perceived usefulness of the chatbot to help them access (and utilise) healthcare services (compared to other interactive media, e.g., social media, official website, advantages or disadvantages of the chatbot, how they may use the chatbot differently from other media) |
| Motivation to use the chatbot                                                       | Participants' expectations of how the chatbot will help them deal with healthcare problems they have.                                                                                                                                                                        |
| Things they like about the chatbot (feature and content)                            | Things that the participant likes about the chatbot for helping them to deal with healthcare problems, particularly                                                                                                                                                          |

|                                                                                            |                                                                                                                                                                               |
|--------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                            | features or dialogue content that they like.                                                                                                                                  |
| Things they dislike about the current implementation of the chatbot (related to usability) | Things that the participant dislikes about the chatbot for helping them to deal with healthcare problems.                                                                     |
| - UI/UX flaws and suggested improvements                                                   | UI/UX, usability problems of the current chatbot implementation, and participants' suggestions about UI/UX improvements                                                       |
| - Unfulfilled expectations (related to care)                                               | Things that the current chatbot is below their expectations, particularly about the contents or features that participants expect to have, but have not yet been implemented. |
| Suggested improvements (new feature and new dialogue content)                              | Participants' suggestions about new features for the chatbot to have, or about new dialogue contents or scenarios (that relate to healthcare).                                |

| Category 5: Chatbot disclosure | Descriptions                                                                                                                                                      |
|--------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Aware                          | Statements that the participant has discovered that the chatbot is operated by a human before the disclosure.                                                     |
| Suspicious                     | Statements that the participant has not discovered the fact that the chatbot is operated by a human before the disclosure, but is suspicious about its behaviour. |
| Not aware                      | Statements that the participant was not aware that the chatbot was operated by a human before the disclosure.                                                     |

## E6: Open questions asked by participants during the WoZ conversation

| Open questions asked by participants                                                                                                 | In Scenario |
|--------------------------------------------------------------------------------------------------------------------------------------|-------------|
| • Do I need to pay for the medicine?                                                                                                 | 2           |
| • Why do I need to pay for the medicine in Boots, and where can I get free medicine quickly?                                         | 3           |
| • What should I bring when I see GP?                                                                                                 | 4           |
| • What medicines should I take if I have a chronic disease?                                                                          | 2           |
| • If I want to buy a POM, which I take every day, how should I communicate with the doctor, or what should I do to prove my illness? | 2           |
| • If I need to take further assessments by specialists, will it be charged?                                                          | 4           |
| • How to make an appointment with a pharmacist?                                                                                      | 2           |
| • How to take the HPV vaccine in the NHS?                                                                                            | 1           |
| • If I feel seriously ill, how can I get help immediately?                                                                           | 2           |
| • How to find the nearest GP?                                                                                                        | 4           |
| • How long will I need to wait to see the GP in person with an eating disorder?                                                      | 2           |
| • How to change GP?                                                                                                                  | 4           |
| • Do I need to pay money after I call 111?                                                                                           | 3           |
| • Should I still go to a pharmacist if I think the illness does not matter?                                                          | 2           |
| • Will I be charged if I call an ambulance?                                                                                          | 3           |