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Technocratic Tuberculosis Control: Health Professionals at the Interstices of DOTS in Shanghai, China

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Abstract

This thesis explores the entangled nature of human and non-human agencies in the making and maintaining of a global health programme in a local setting. Specifically, it investigates how public health professionals engage with and enact the technocratic management of tuberculosis control as per the DOTS approach in contemporary Shanghai. My research is based on a fourteen-month internship with the Shanghai Centre for Disease Control and Prevention (SCDC) and examines the mechanics of tuberculosis control in the metropolis at the municipal, district and community levels.

In this thesis, I show how non-human agents intrinsic to the functioning of DOTS – protocols, standards, numbers, technology, concepts such as 'compliance' and 'scale', inter alia – are both useful and risky. They bring consistency and accountability, assert compliance and conformity, but also set limitations for the project of recovery and cure. As such, considerable *maodun* (矛盾) or contradictions arise when technocratic policy and sick patients meet, and I demonstrate how these moments offer rich opportunities for understanding how DOTS operates in a local context.

Public health professionals are positioned in between policy and patients, and both occupy and constitute the interstices that separate and connect the two. I argue that they negotiate these moments of *maodun* to make DOTS fit for human use. I further suggest that they do so through their subjective engagement, exertion of emotional labour, and exercise of discretion in managing technocratic tuberculosis control. Entangled with the influence of non-humans, this thesis argues that the choices and actions of public health professionals inform the formation of their own interstitiality and, recursively, make and shape the nature of tuberculosis and its control for patients in Shanghai, for China, and for the Global Health project more widely.

Rooted in medical anthropology and the Shanghainese experience, this thesis contributes to wider discussions on the human and non-human in the co-production of knowledge, and the pivotal role played by individuals to exert profound influence within the larger and technocratic.

Lay Summary

This thesis explores how humans and non-humans co-produce a global health programme in a local setting. Specifically, it investigates how public health professionals carry out the technocratic management of tuberculosis control according to the DOTS approach in contemporary Shanghai. My research draws from fourteen months of fieldwork and examines how tuberculosis control is enacted at the municipal, district and community levels.

In this thesis, I show how non-human agents that are a part of DOTS, such as protocols, numbers, technology, and ideas such as ‘compliance’ and ‘scale’, are both useful and risky. They can both assert and limit the treatment and recovery process. As such, *maodun* (矛盾) or contradictions may arise when policy and the real lives of patients misalign. Studying these instances of *maodun* and misalignment offers a way to understand what happens when DOTS is applied in a local context.

Public health professionals are the interface between the patient and policy and I argue that they negotiate these *maodun* that arise by problem-solving issues for the patient. They do this by drawing on their experience, carrying out labour that goes officially unnoticed and unrecorded, and considering each patient’s circumstances individually rather than treating all patients as the same. This thesis argues that public health professionals are influenced by non-humans (and vice versa) in determining the choices they make and actions they take. It is this entanglement that recursively makes and shapes the design of DOTS and how it impacts patients in Shanghai, China and the wider goals of Global Health.

While this thesis is based on medical anthropology and in the Shanghainese context, its analyses contribute to wider conversations on the human and non-human and how they co-produce knowledge, and how individuals can have a profound influence within larger technocratic systems.

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List of Abbreviations

Abbreviation	Full term
ACF	Active Case Finding
AFB	Acid Fast Bacilli
AMR	Antimicrobial Resistance
AMS	Antibiotic Stewardship
BCG	Bacillus Calmette-Guérin
BRICS	Brazil, Russia, India, China, South Africa
BSL-	Biosafety level-
CATA	Chinese Anti-tuberculosis Association
CCP	Chinese Communist Party
CDC	Centre for Disease Control and Prevention
CHC	Community Health Clinic
CNAS	Chinese National Accreditation Service for Conformity Assessment
CT	Computed Tomography
DOTS	Direct-observation Therapy, Short-course
DR-TB	Drug-resistant Tuberculosis
DRS	Drug-resistance Surveillance
DST	Drug Sensitivity Testing
EBA	European Biosafety Association
EIS	Epidemic Intelligence Service
EQA	Evaluation and Quality Assurance
EUR	Euros; European currency
GBP	Great British Pound
GPS	Global Positioning System
HGT	Horizontal Gene Transfer
HIV	Human Immunodeficiency Virus
IEDC	Infectious and Endemic Disease Control
LJZ-FTZ	Lujiazui Financial and Trade Zone
LTBI	Latent Tuberculosis Infection
MDGs	Millennium Development Goals
MDR-TB	Multi Drug-Resistant Tuberculosis
MERS	Middle East Respiratory Syndrome
MTB	*Mycobacterium Tuberculosis*

PCF	Passive case-finding
PPH	Pudong Pulmonary Hospital
PRC	People's Republic of China
RMB	Renminbi
SARS	Severe Acute Respiratory Syndrome
SARS-CoV-2	Severe Acute Respiratory Syndrome-Coronavirus-2
SAT	Self-administered Therapy
SATA	Shanghai Anti-tuberculosis Association
SMC	Shanghai Medical College
SS+/-	Sputum Smear +/-
STS	Science and Technology Studies
SCDC	Shanghai Centre for Disease Control and Prevention
SOP	Standard Operating Procedure
SPH	Shanghai Pulmonary Hospital
STP	Shanghai Tuberculosis Programme
S&T	Science and Technology
TBMIS	Tuberculosis Information Management System
TDR-TB	Totally Drug-resistant Tuberculosis
TSC	Transnational Scientific Common
VGT	Vertical Gene Transfer
XDR-TB	Extensively Drug-resistant Tuberculosis
X-ray	X-radiation or radiography
WB	World Bank
WCTM	Whole Course Treatment and Management
WHO	World Health Organisation
Z-N	Ziehl-Neelson

Glossary

Pinyin	Simplified Mandarin	English Translation
Anwei ziji	安慰自己	Comfort yourself
Baomu gongsi	保姆公司	Domestic cleaner recruitment agency
Baogao jishili	报告及时里	Timely reporting
Banshiyao	版式药	Combination medications
Bianhao	*编号*	Serial number
Biaomian	表面	Surface appearance
Biaoxian	表现	Performance
Biancheng buhao guanli	变成不好管理	Become difficult to manage
Bufu zeren	不负责任	Irresponsible
Chaiqian	拆迁	To demolish and relocate
Chijiao yisheng	赤脚医生	Barefoot doctor
Chuanranyuan	传染原	Infectious agent
Chuanshi lao	传尸痨	Corpse-transmitted consumption
Chugan	触感	Touch/feeling
Danwei	单位	Work unit
Dianfu	颠覆	Subvert
Dingdian yiyuan	定点医院	Designated hospital
Dishuiping guangfugai	低水平广覆盖	Low level, wide coverage
Fading chuanranbing	法定传染病	Notifiable infectious disease
Fangyizhan	防疫站	Anti-epidemic stations
Feijiehebing	肺结核病	Pulmonary tuberculosis
Gaige kaifang	改革开放	Reform and Opening Period
Ganjing	干净	Clean

Geren	个人	Individual
Goutong	*沟通*	To communicate
Guahao	挂号	Registration
Guan	关	To care/control
Guanai	关爱	Loving care
Guancha	观察	To observe
Guanli	管理	To manage
Guanli gongzuo daoweile	管理工作到位了	Management work is satisfactory
Guanli yisheng	*管理医生*	Managing doctor
Guanxi	关系	Social networks of influential relationships
Guanxin ta	关心他	Care for them
Guilu	规律	Regular/disciplined
Guomingdang	国民党	The Nationalist Party
Guoyu	过于	Excessive
Heixin	黑心	Black-hearted
Huai	坏	Bad
Huaren	华人	Overseas Chinese
Huji bu	户籍簿	Hukou passbook
Hukou	户口	Household registration
Jiehebing	结核病	Tuberculosis
Jiehe kanyuan	结合抗原	Tuberculosis antibiotics
Jin	斤	A catty (five hundred grammes)
Juweihui	居委会	Neighbourhood committee
Juzhuzheng	居住证	Resident’s permit
Kaidao	*开导*	To enlighten
Kang	抗	Heatable brick bed

Kaohe	考核	To evaluate
Kexue	科学	Science
Kexue juece	科学决策	Scientific policymaking
Kuaidi	快递	Fast delivery
Laobaixing	老百姓	Ordinary people
Laojia	老家	Hometown
Laoshi	老师	Teacher
Laowai	老外	‘Old outsider’
Lianse	脸色	Face colour/pallor
Lingchuang yisheng	*临床医生*	Clinical doctor
Lingdao	领导	Leader
Liudong renkou	流动人口	Floating population
Mahjiang	麻将	Tile-based game
Mao	毛	Pence
Maodun	矛盾	Contradiction
Meibanfa	没办法	There’s no other option
Mianzi	面子	Face
Mijie shaicha	秘结筛查	Close-contacts screening
Nimen nabian zenme yang	你们那边怎么样?	How are things over your side?
Nanshou	难受	Uncomfortable/Hard to bear
Pubian	普遍	Widespread
Qian	钱	Money
Qiancheng	虔诚	Devoted
Qianghuaji	强化剂	Intensify
Quan	权	Power
Quanli	权力	Authority
Quanli	权利	Right to benefit
Quanwei	权位	Power by virtue of position

Qunzhong	群众	The masses
Quezhen	确诊	Confirmed
Renkou	人口	Population
Renmin	人民	The People
Renqing	人情	Human feelings
Shanghai shi weisheng jiankang weiyuanhui	上海市卫生健康委员会	Shanghai Municipal Health Commission
Shenwu anquan	生物安全	Biosafety
Shisi	事实	Reality
Suzhi	素质	Quality
Tongku	痛苦	Painful
Tongyi fenpei	同一分配	Unified state assignment
Waidi ren	外地人	Outsider
Waiguoren	外国人	Foreigner
Wanmei de biaomian	完美的表面	Beautiful outer appearance
Weijumin fuwu	为居民服务	Serve the residents
Weirenmin fuwu	为人民服务	Serve the People
Xian	嫌	Resent/suspicious of
Xianzhan	嫌脏	Resent dirtiness
Xianqi wo	嫌弃我	Have distain for me
Xiaomie	消灭	Annihilate
Xiyao	西药	Western medicine
Yaome quan yaome qian	要么权 要么钱	You either have power or money
Yangsheng	养生	Nourishing life
Yibao	医保	Public health insurance
Yilu	疑虏	Misgiving
Yinao	医闹	Medical dispute
Yisi bingli	疑似病例	

Yiqing dongren, yiqing ganren	以情动人，以情感人	Move/touch people with empathy
Yiqing he jiance	疫情和检测	Outbreak and monitoring
You yisi	有意思	To be meaningful
Yunxu	允许	Permit
Zhanzhuzheng	站住证	Temporary resident's permit
Zhiyu	治愈	Cure
Zhongguo fanglao xiehui	中国防痨协会	Chinese Anti-tuberculosis Association
Zhongchengyao	中成药	Traditional Chinese medicine
Zhudaozhe	主导者	Leader
Zhunzhong	尊重	Respect
Zhibiao	指标	Quota/Target
Zhiliang	质量	Quality
Zhuiqiu	追求	Pursue
Zili	自理	Independent
Zilü	自律	Self-disciplined

PEOPLE AND PLACE NAMES

Pinyin	Simplified Mandarin
Chen	陈
Cheng	程
Dong	董
Fan	范
Feng	冯
Gong	龚

Gao	高
Hu	胡
Kang	康
Liu Wen	刘文
Luo	罗
Mei	梅
Qin	钦
Shan	鄯
Sun	孙
Tian	田
Wei	魏
Wu	*吴*
Wu Liande	*伍连德*
Wu Shaoqing	吴绍青
Xiao Zhang	小张
Xu	徐
Yin	殷
Yan Fuqing	颜福庆
Yang	杨
Ying	应
Zhao Shukai	赵树凯
Zhou	周

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Introduction

The brightly lit room is stirring to life. It's almost 9 am and people are slowly filtering in. Some individuals spot familiar colleagues and they strike up cheerful conversations in low tones. The tables and chairs have been arranged into a large square formation so that everyone can see each other. Cups of green tea have been filled with hot water and paper and pencils have been laid out. The volume in the room gradually rises now that more are arriving. Between handwaves, smiles and the exchange of gossip, we move to take our seats around the table.

It's the second morning of the Shanghai Centre for Disease Control and Prevention (SCDC) tuberculosis department's 2014 annual meeting. Public health professionals from the municipal, district and community levels meet at this yearly gathering to present their year's work, debate and discuss difficulties they've encountered, and share with each other possible solutions drawing from experience and experimentation. There are multiple parallel sessions and I have decided to sit in on one entitled: *Management of floating population patients and MDR-TB in Shanghai's outer suburbs*. The sessions are all topical; it's a shame I can't attend them all. The one I've chosen addresses mobility, drug resistance, and patients living outside of downtown Shanghai, the majority of whom are migrant workers who form part of the country's 'floating population' (流动人口; *liudong renkou*). I have been stationed in downtown so far and am eager to learn more about the suburbs. We're all seated now, and there's an anticipatory hush as we wait for the session to begin. Dr. Kang (康), director of patient management, begins the session:

> It is different managing tuberculosis within the city compared to in the suburbs. The suburban districts have the highest numbers of patients and the largest number of the floating population. Moreover, we know that the majority of patients are from outside of Shanghai and that within this majority, it's mostly younger people who contract tuberculosis. This is in contrast to the majority of local Shanghainese patients being older adults suffering from activated latent infections. Based on these figures, more migrants should be cured as younger people have better responses to drug treatment than older patients. However, the data we've collected doesn't reflect this and many migrant patients' treatments are not completed. This of course has implications for drug

resistance and the growing issue of multi-drug resistant tuberculosis (MDR-TB) and even extensively drug-resistant tuberculosis (XDR-TB).

We are now finding patients presenting in clinic with M/XDR-TB as a first-time infection. Previously, M/XDR-TB patients were usually those who had contracted standard tuberculosis, or what's called drug-susceptible tuberculosis, but were inconsistent in taking their medication or did not finish their drug treatment. The bacteria became resistant to the two first-line drugs we have and mutated into a drug-resistant strain. If the patient continues to inconsistently take their drugs or stops taking their drugs due to side effects or other reasons, then, eventually, the bacteria become resistant to the two first-line drugs and two of the second-line drugs and mutates into what's known as XDR-TB.

Now, with this direct drug-resistant infection, we can see that a more virulent and difficult to treat strain of tuberculosis is in circulation not only in Shanghai but throughout China and globally. MDR-TB treatment entails taking drugs for 18 to 24 months with significant side effects and with only a 52% success rate. XDR-TB treatment is even lengthier, more complex, and success rates are lower. Rates of recovery from tuberculosis are compounded by human immunodeficiency virus (HIV) co-infection and a new programme for targeting TB/HIV co-infection commenced this year.

I know you are all working to manage these patients and striving for successful follow-up and treatment completion. If those of you in the outer suburbs could succeed in this task, then we could say that we in Shanghai have controlled the spread of tuberculosis amongst the floating population. This would be a significant achievement nationally as the floating population is increasing all the time, as is the number of drug-resistant patients. As we know, drug-resistant tuberculosis is the biggest problem facing tuberculosis control worldwide at present. You are the people on the ground and so it is you who have the most experience in interacting with patients.

I know there have been issues, such as it being difficult to find a family representative to observe patients who can't or won't come to clinic, and I know that some patients can be very difficult to deal with, some even verbally abusive, and that there are those who refuse to take their medications. And then there are the patients who cannot be found, who give wrong addresses and wrong phone numbers, and whose treatment status becomes and remains

unknown. I am aware and sympathetic to the challenges you face in your positions. Let's take this opportunity today to share with each other any insights and experiences that can help us as a public health system in working towards controlling tuberculosis in Shanghai.

A retired district director is asked to speak on some of the issues raised; implicit in these concerns is the knock-on effect they have on the numbers and statistics that subsequently get reported. He addresses the anxieties around rising rates of drug-resistant infections both nationally and globally; the higher prevalence of direct MDR-TB infections; the numbers of patients who exhibit non-compliance; patient mobility and even disappearance that complicates statistical totals; and the maintenance of Shanghai's performance numbers, and therefore national standing, for tuberculosis control. Directors from the different district CDCs then take turns to present some of their experiences and invite advice on how to deal with conundrums and controversies they've encountered.

What starts out as a relaxed entry into conversation soon becomes animated and impassioned as the speakers express their frustrations, identify with one another, and recount their exasperations. Anger, confusion, anxiety and, in some cases, dejection can be felt and observed. The call to 'lock them up!' is heard a few times. Those with some more years under their belt offer tempering words such as *yiqing dongren, yiqing ganren* (以情动人，以情感人; move and touch others with empathy). With these words, they encourage their colleagues to listen to their patients, even if they are angry. They counsel that showing empathy can make discussing treatment easier. Different suggestions are made; some are taken on board and others are challenged. Soon the volume in the room rises as all the attendees are having separate conversations with each other or in groups and in loud voices, collectively expressing grievances and hashing out solutions, or making concessions. The session ends with polite yet strained jokes and smiles to shrug off the unsatisfactory state of affairs. The group filter out of the room, some still carrying on their conversations, and make their way to the eighth floor for lunch.

I was to sit in on many more such meetings throughout my fieldwork. For the hierarchical and bureaucratic state-run institution of the SCDC, these gatherings were occasions when organisational and strategic plans were discussed in the present for the sake of an imagined and aspired-to-future (H. Brown, Reed, and Yarrow 2017

drawing on R. H. R Harper). Whether it was a training session, a weekly group meeting, a monthly presentation, a biannual auditing, an annual conference, or an informal huddle, these scenes were instances of public health knowledge production and performance. These generative moments were enabled by the efforts of health professionals, some of whom populate the pages to come.

This thesis undertakes to provide an ethnographic account of how this community of public health professionals engage with and enact a global health tuberculosis control programme in the local setting of contemporary Shanghai from 2014-2015. In what follows, I show how attending to the pivotal position they occupy in between policy and patients affords unique insight into how this programme, DOTS: Direct-observation Therapy, Short-course, operates in Shanghai and how tuberculosis control is made and maintained in the city. These health professionals man the interstices that at once separate and connect, on the one hand, words written on paper and, on the other, the lived realities of patients. It is through the efforts made by health professionals that policy is transformed into action that comes to make a difference to patients' lives. Crucially, how they enact policy exerts effects on patients' experiences of illness and recovery, and influences the production of public health knowledge that further informs policy. They do this work in tandem with and in response to a multiplicity of non-humans that populate public health and compel human behaviour. Based on a fourteen-month internship with the SCDC Department of Tuberculosis, this thesis explores the entangled nature of non-human and human agencies in the everyday making and maintaining of DOTS in Shanghai. It does this through examining how health professionals at the interstices engage with and enact the technocratic management of tuberculosis control.

Throughout the thesis, I show how non-human agents intrinsic to the functioning of DOTS – protocols, standards, numbers, technology, concepts such as 'compliance' and 'scale', inter alia – are both useful and risky. They are used to standardise ways of handling microbial entities endeavouring to survive, as well as the actions of human doctors and patients whose inconsistent and unpredictable behaviour has been pinned as the cause of the disease's continued proliferation and decades-long rise in drug-resistant tuberculosis (DR-TB) rates. Indeed, DOTS has been the gold-standard programme endorsed by the World Health Organisation (WHO) since 1994 and is reported to have saved an estimated 66 million lives between 2000-2020.[1] Standardisation and decision-making based on scientific counting and technical testing have undoubtedly had positive effects on the global

[1] https://www.who.int/news-room/fact-sheets/detail/tuberculosis

tuberculosis pandemic (Chaisson, Frick, and Nahid 2022).[2] However, the use of these non-human devices is two-sided. They bring consistency and accountability, assert compliance and conformity, but also set limitations for the project of recovery and cure through the use of narrowly specific and standardised categories, definitions and methods of measurement (e.g., Bowker and Star 2000). At its core, the thesis explores how health professionals negotiate the *maodun* (矛盾) or contradictions that arise from the use of technocratic means for the management of infectious disease control. I suggest they intervene in these moments of *maodun* through their subjective engagement, exertion of emotional labour (Hochschild 1983; Theodosius 2008; D. Wu 2021), and exercise of discretion (Lipsky 1980) to make DOTS fit for human use in local lived realities.

The moments when "the ideal model does not work as expected – mundane and dramatic points when experts must negotiate around, and through, and with the ideals they describe" (O' Reilly 2017, 8) present exceptionally rich opportunities for peering behind the veil. Health professionals are trained to carry out standard operating procedures (SOPs), handle live bacteria, manage patients' adherence to treatment schedules and drug regimens, and produce the inscribed material artefacts to prove that they have done so. They work with and through these non-humans that are used to define reality and direct action. In moments of *maodun* and misalignment, health professionals labour to reconcile contradictions between policy and patients. Their actions break up the clashes (Mol 2002), perhaps even presciently avoiding them altogether, and, in doing so, reinforce the relevance of the policy they have been assigned to carry out. These misalignments or averted clashes are not officially recorded nor reported 'up', however, rendering their labour effectively invisible. This omission ensures that the *biaomian* (表面) or surface appearance of tuberculosis control is maintained and thus sustains the epidemiological imaginaries (Reubi 2020) that inform the programme's steady march towards aspired-to futures. Attending to how health professionals negotiate and *choose* to manage these moments is instructive for understanding how DOTS functions in theory and in practice in Shanghai.

Some of these *maodun* are mentioned by the director of patient management in the scene above. In his introduction to the session, he touches on the nature of

[2] Tuberculosis has been consistently referred to as an epidemic and in terms of a country's epidemic. The fact that tuberculosis exists in every country in the world constitutes it as a pandemic although of the more chronic kind due to its etiology, as compared to the unprecedented speed of infection seen with, for example, the SARS-CoV2 virus.

social life in Shanghai and contemporary tuberculosis epidemiology, including the consistent and worrying rise of DR-TB. Post-socialist China is a country of growing social and economic disparity since the beginning of the Reform Period in 1978 (Lu 2007). Moreover, the loosening of human mobility has posed a formidable challenge to the control of an airborne disease (see Chapter One for more on the historical development of public health and tuberculosis control in the country and in Shanghai).[3] Shanghai is China's largest city and the economically indispensable migrant workers, also referred to as the 'floating population' (流动人口; *liudong renkou*), comprise the majority of the city's demographic. They also make up the majority of tuberculosis patients in the city. This is due in part to their being more likely to live or subsist in poorer living conditions – cramped, with poor ventilation and a shared kitchen and bathroom – than local Shanghainese, have nutritionally poorer diets, carry out more physically tiring work and for longer hours, and interact with others in similar circumstances. The socio-economic determinants of health are still highly relevant for this disease of inequality (e.g., Farmer 2001; Dubos and Dubos 1987). The second major patient demographic is elderly local Shanghainese patients who suffer from activated latent tuberculosis infections (LTBI) rather than a newly contracted illness.

The long treatment duration, having to pay for costs upfront before being reimbursed at the point of cure (see Chapter Four for discussion on this reimbursement scheme), and not being permitted to work make treatment default a common issue of concern for tuberculosis control and the disturbing rise in acquired drug resistance. Drug resistance is the reduction in an antibiotic's effectiveness to cure a disease, such as in cases of drug-resistant tuberculosis (DR-TB). It is an effect of antimicrobial resistance (AMR), which, in 2019, was associated with almost 5 million deaths (Antimicrobial Resistance Collaborators 2022). Of these deaths, 1.27 million were directly attributable to AMR (Ibid.), with tuberculosis "the leading cause of death from antimicrobial-resistant infection" (Long et al. 2021, e948). Moreover, China carries the second-highest burden of multi-drug-resistant tuberculosis (MDR-TB) worldwide. The WHO has coined the global issue of AMR as a 'silent pandemic' and declared that it is caused by irresponsible prescribing of antibiotics by health professionals and treatment non-compliance by patients.[4] While these behavioural factors certainly contribute to the cultivation of AMR, I demonstrate in this thesis that

[3] This research was carried out in 2014-2015 before restrictions were put in place as part of China's anti-Covid measures.

[4] https://www.who.int/news-room/articles-detail/global-antimicrobial-resistance-forum-launched-to-help-tackle-common-threat-to-planetary-health

they are not the only variables. By examining the theoretical and conceptual assumptions upon which DOTS is based and the moments of *maodun* that can result, I argue that DOTS' design not only contributes to the cultivation of but further entrenches AMR due to its insistence on standardisation and sole focus on pharmacological treatment in managing an airborne social disease of inequality. As we will see, moments of *maodun* can offer opportunities for microbial experimentation to take place, contributing to the development of DR-TB despite the best efforts of health professionals endeavouring to fulfil protocol (see Chapter Three for more on the mechanisms of AMR).

In fact, DOTS was designed in the 1970s to not only treat patients but to avert the acquisition of drug resistance. It was premised that standardisation would ensure the proper and effective prescription and use of antibiotics managed through constant surveillance enacted by humans. The method requires patients to attend clinic daily and be directly observed taking their drugs by a health professional. This includes checking under patients' tongues to ensure the medications have been swallowed. Across countries and contexts, the daily DOT of patients has proved challenging to implement and sustain for both health professionals (e.g., Dalazoana, Gabardo, and Cardoso 2021 for an example from Brazil) and patients (e.g., Mukerji and Turan 2020; and Birch et al. 2015 for examples in India and South Africa) due to logistical and socio-economic constraints and limited resources. In Shanghai, with the number of patients far outnumbering tuberculosis health professionals, the municipality enacts a form of family-administered therapy whereby a family member is tasked with directly observing treatment every day. Self-administered therapy (SAT) is used if a family member is not available for the task. Patients must also visit designated hospitals monthly rather than daily to pick up their prescriptions. Shanghai, therefore, does not enact DOTS in practice – despite the label, health professionals have had to adjust the programme to make it fit for human use in this major metropolis out of necessity.

Instead, I argue that it is the entangled human and non-human enactment of technocratic tuberculosis control that creates the appearance of standardisation and procedure. Non-humans, such as indicators and documents (see Chapters Four and Five), evidence that protocol has been followed and construct the 'reality' that DOTS has been carried out. Anything that deviates from standards and protocol, such as logistical and socio-economic constraints, is not counted or, instead, recorded as a failed incident, with the details of that 'failure' rendered invisible. This public health data is subsequently reported to global health institutions monitoring the outcomes of DOTS worldwide. With the primary data informing programme design and

continuation being produced in this way, a major motivation of this thesis is to ask: what is the nature of data being generated by the DOTS programme, and how representative are they of the lived realities experienced by health professionals and tuberculosis patients? Chapter Six examines these questions within the wider international context by considering how such data informs the development of China as an equal contender within the global health arena and, thus, how the country contributes to the larger project of Global Health itself.

The voices of epidemiologists, laboratory technicians, public health specialists, preventative health doctors, and clinicians populate the pages to come. The thesis seeks to explore the richness inherent in the space in-between, of the non-human and human co-production of tuberculosis control, and how moments of *maodun* and misalignment can reveal much of how things operate behind numbers and protocols. In the following sections, I first present the areas of literature I have drawn from to inform my analyses and position my thesis. I take an interdisciplinary approach and explore the nexus where medical anthropology, the history of science, the history of medicine, science and technology studies (STS), and East Asian studies meet. I draw from a rich resource of literature in these areas to help me unpack and develop my theoretical framework under the following headings: the role of health professionals; non-humans and the co-production of technocratic knowledge; and China and the technocratic. Second, I turn to a description of my fieldsites – the municipal SCDC institution, district branches and community health clinics – and the methodology I deliberated and pursued in carrying out and writing up this research. In the third section, I explore the ethical considerations that arose and discuss my reflexive reflections to provide more context and further situate the study. Finally, in the fourth section, I provide an overview of the chapters that will form the main body of this thesis.

THE ROLE OF HEALTH PROFESSIONALS

Literature from medical anthropology provides a firm foundation from which to begin examining global and public health (Qureshi 2022; Dixon and Macdonald 2018; Adams 2016; E.L. Fan 2016; Prince and Marsland 2014; Biehl and Petryna 2013), the management of tuberculosis (Venkat 2021; Kehr 2020; MacDonald and Harper 2020; Dixon and Tameris 2018; K. Mason 2016a; Koch 2013b, 2013a, 2011; Armus 2011; Harper 2006, 2010; Draus 2004; Farmer 2001, 2000), and studies that contribute to the anthropology of health systems (Closser et al. 2022; especially Maes 2016). Focusing on the role of health professionals, I take them to be individuals who have

received technical training and been socialised in a medical mode of being and seeing (see Prentice 2012; Wendland 2010; and Good 1993 for clinical examples). Concomitantly, they are also individuals with their own personal histories and subject to the pushes and pulls of everyday life in a Chinese city (K. Mason 2016a; Kleinman et al. 2011; E. Zhang, Kleinman, and Tu 2011). They hold their own value systems, have their own interests and concerns at stake, and exercise judgement based on their personal and professional perspectives (Wierciński 2021; Montgomery 2006). Their work is creative, having to respond to the constellation of conditions extant in any one case whilst actualising a particular vision of state health provision.

I therefore take their interstitiality (Judith 2023) seriously and the significance of their occupancy of the in-between (Ingold 2015) as a given. In environmental humanities scholar Kate Judith's exploration of interstitiality through looking at mangroves, she makes a point of highlighting "the extent to which human intentionality and material agencies are already thoroughly mangled before they get into spaces" (Judith 2023, 8). Her work proposes examining the "mangal of practice" as a way of building upon and moving beyond sociologist Andrew Pickering's 'mangle of practice' (Pickering 1995), which she critiques as being predicated upon the centrality of human intention in the forceful transformation of scientific knowledge. Instead, Judith argues that the material semiotics involved in production and creation render the process more akin to the 'filter-feeding' performed in the ecology of mangroves whereby the mud, creatures, tides, weather conditions and so on all contribute to the formation of the mangrove's geobiome. This theorisation draws from the concept of intra-action proposed by feminist scholar Karen Barad (Barad 2007, 2014) whereby agents, human and non-human alike, are co-constituted through the mutual entanglement of their agencies. This is in contradistinction to 'interaction', which assumes the a priori constitution of agents before they encounter each other. To think in terms of intra-action is to consider agents and agencies – the ability to act – as materialising from within relationships rather than from outside of them. These relationships are in constant flux, being made, unmade and remade, and are therefore creative instead of fixed phenomena. I also draw from anthropologist Timothy Ingold's conceptualisation of the in-between as the midstream rather than the intermediary (Ingold 2015). Evoking a flowing river between two banks, Ingold writes that the "becoming of persons and things [takes place] within the midstream of correspondence, rather than on the intermediacy of interaction [i.e., between bank and bank]" (Ibid., 152). These writings from anthropology, feminist studies and the environmental humanities inform my theorisation of humans and non-humans as actants, and their entanglement in the co-production of knowledge.

This research took place in 2014-2015 when there was increasing interest in the role of health professionals. The present thesis seeks to add to this literature and to work on public health in China, being one of only three conducted on the Chinese CDC institutions and the only one with a focus on the social disease of inequality, tuberculosis.[5] In their proposal of an anthropology of health systems, Closser et al. (2022) highlight research into the lives and role of community health workers as a significant area of focus (Logan 2019; Maes 2016; Colvin and Swartz 2015). These studies have examined the public health worker as being pivotal to the programme due to their familiarity with their community, which is one usually socially and politically marginalised. These community health workers advocate on behalf of their patients to overcome health disparities and challenges. However, I agree with anthropologists Christopher J. Colvin and Allision Swartz that the labour of these individuals is not to be reified as the solution to wider issues intrinsic in health systems (2015). To fill out this picture, my research 'studies up' (Nader 1972) and investigates the role of health professionals whom I take to be experts (Carr 2010) as well as private individuals with their own personal as well as professional experiences. I take expertise to be inherently ideological and "interactional because it involves the participation of objects, producers, and consumers of knowledge" (Ibid., 18). Officially, the health professionals I worked with were considered professional for following protocol and not for advocating for the benefit of their patients, although many did exert extra 'invisible labour' (Hochschild 1983) for this end. Moreover, I look at the tuberculosis control programme as a whole by examining expertise on all three levels of the public health system – the municipal, district and community – rather than at one level only. In this way, my work considers the institution of the SCDC itself as an object of enquiry vis-à-vis its constitution through the expertise and actions of health professionals.

NON-HUMANS AND THE CO-PRODUCTION OF TECHNOCRATIC KNOWLEDGE

Lively scholarship from the history of science, STS and anthropology has spurred thinking through and with non-humans in the co-production of knowledge and social life (Jasanoff 2004). Explorations into the agency of technology (Latour 1996), concepts and ideas (Mol 2002), objectivity (Daston and Gailson 2007), science and the making of facts (Latour 1987; Latour and Woolgar 1986), infrastructure (Star 1999),

[5] Anthropologist Christos Lynteris has carried out research with the national CDC in Beijing (Lynteris 2013). Anthropologist Katherine Mason has carried out research with a CDC institution in Shenzhen (K. Mason 2016a).

paper and documents (Ansari 2022; Hull 2012; Riles 2006), inscription (Kafka 2012; Latour and Woolgar 1986), standards (Lampland and Star 2009), rules (Daston 2022), numbers (Porter 1995; Wise 1995), cells (Landecker 2007), and microbes (Landecker 2016; Paxson and Helmreich 2014; Hird 2009) have elucidated the profound influence of non-humans. In terms of microbes, researchers have demonstrated how the ways in which we imagine these sub-visible entities profoundly impact how we live with them (Paxson and Helmreich 2014; Helmreich 2009). The mutuality of microbe-human becoming has important implications for how we come to understand ourselves (Rees 2019; Rees, Bosch, and Douglas 2018; Helmreich 2015) as well as inducing microbial experimentation or what is known as drug resistance (Landecker 2016; Hird 2009; Margulis and Sagan 2002).

Historian Matthew S. Hull's study of the "material forms of documentation and communication" (Hull 2012, 1) is relevant for an examination of DOTS, which is itself essentially a programme for the administration and management of tuberculosis control (WHO 1999). He demonstrates the central function played by these "graphic artifacts" (Hull 2012, 1), as he refers to them, in the Pakistani bureaucracy and argues that these non-humans influence human life and decision-making by mediating how procedures, protocols, negotiations and contestations are enacted. Moreover, non-humans are further complicit in the making of other objects and although their influence may operate at an unconscious level, this does not detract from their centrality. In fact, the influence of graphic artefacts is inscribed into them and their efficacy comes "as much from how they circulate as from what they say" (Ibid., 24). Anthropologist and philosopher Annemarie Mol (2002) has shown us how different, even contradictory ideas can be concurrently circulated and held about the same object. Rather than there being a single truth, their simultaneous validity can be coordinated and distributed so that multiple conceptions can coexist at once, rendering the influence of non-humans versatile and malleable. Value can be inscribed onto them through their circulation, with the process of circulation drawing these associations together and even bringing their referents into the fold. In this thesis, I examine the significance of numbers – often inscribed and circulated on material forms of documentation and communication – and their agency and influence in the production and determination of public health knowledge and work.

Indeed, the use of metrics has become the predominant method of knowing and knowledge production in the global health arena and more widely (Biruk 2018; Muller 2018; Adams 2016; Shore and Wright 2015; A.B. Kipnis 2008; Strathern 2000a). This "tyranny of metrics" (Muller 2018) functions through its exclusion of unknown knowns, whereby an intrinsic confounding factor may be widely known but not

officially acknowledged, attended to, or measured. It is instead treated as being unimportant and "must remain in the known unknown space of daily engagement to do its work" (Geissler 2013, 21) of enabling science and public health to function smoothly. Geissler draws on anthropologist Michael Taussig's idea of 'public secrets' (1999) and the practice of unknowing as a,

> condition of scientific knowledge production under given material conditions; in turn, it shapes this scientific work and sustains and exacerbates some of its inherent political-economic contradictions. (Ibid., 13)

Scholars have further addressed the significance of 'absence' by "making ignorance an object of ethnographic enquiry" (High, Kelly, and Mair 2012, 1) and through examining the "structural production of ignorance" (Proctor and Schiebinger 2008, 3). Anthropologist Martha Lampland has shown us how numbers do not need to be true and, instead, how provisional numbers can be effective as placeholders for the potential truth. In fact, false numbers may be used "when the primary task is to learn how to deploy numbers" (Lampland 2010, 378). Using these kinds of numbers makes the actual values that numbers represent unimportant for the purposes of justifying action taken in the present for an aspired-to future. Indeed, philosopher of science Thomas Kuhn has investigated how liberties are taken (for example, information is put on hold) in order to explore laws and theories and bring them closer to articulation. Writing on the study of physics, Kuhn attributes this practice to the "immense difficulties often encountered in developing points of contact between a theory and nature" (1970[1962], 30). I find resonance here between these studies and the design of DOTS, with its heavy reliance on science, technology and technical methods of measurement in managing lived experiences of illness.

Literature from medical anthropology and the anthropology of development has interrogated the design of global health programmes and how they come to be so technical. Anthropologist Tania Li has interrogated the concept of 'intervention' and made it strange by exploring how social issues are 'rendered technical' (T. Li 2007). She describes how the rendering process breaks down social problems into matrices, defines its constituents, identifies the influencing vectors, and separates out these components to facilitate planning. Analysis is then enabled by and visualised through the use of numbers and statistics, making the indicators they measure comparable across space and time (Merry 2016). Social issues are then problems that experts hold the key to solving – if only the steps they recommend are followed. This makes overcoming these problems a linear process that is defined, operationalised, managed, measured and judged by technocratic expertise. Such expertise is a form

of power that goes unquestioned in this arena – the power to determine what is best for others and how they ought to live and be.

This technocratic power to 'care' for what is best for others, and the ability to impose that care onto others, must be understood in context (de la Bellacasa 2012) and with awareness of the long political histories they come from (Murphy 2015). Explorations of care have shown how it can be helpful and supportive (Kleinman and Van Der Geest 2009), oppressive and controlling (Zhu et al. 2018; Ticktin 2011), something negotiated (Kaufman 2015), ambivalent (Hyde 2017; Stevenson 2014; Mol, Moser, and Pols 2010) and a device employed to achieve specific ends (C. Zhang and Song 2020). Like these scholars, I find the rendering technical of social issues into problems to be fixed through the use of protocols, numbers, statistics and standardisations that stake their claims in science, technology and expertise particularly compelling in the ways it depoliticises and dehistoricises (Ferguson 1994) global and public health programmes with long political histories. I am also interested in the effects of such technical interventions when applied to deeply social and political phenomena over time.

Anthropologist Annelise Riles (2004) has interrogated the technocratic by noting its self-sustaining nature. The nature of the technocratic object of interest – what it is, should be and how to improve it – is made and managed by those who study, uphold and carry out its logics (O' Reilly 2017). Researchers have demonstrated "the way technocratic power is 'the product of knowledge and extraordinary performance'" (Riles 2004, 392 quoting Winner) that reinforces the belief that there is no higher arbiter than scientific knowledge. The use of technocratic methods entails the mathematical abstraction of social phenomena for the purposes of planning, and, once rendered into numbers, these phenomena are stripped of their true complexity (Merry 2016; Riles 2004) – indeed, I would add that part of what makes this performance extraordinary is the way in which it is carried out through ordinary actions taken in the everyday. Failures that arise are occasions for more technocratic intervention. They become "the engine of more technocracy" (Riles 2004, 393; see also Muller 2018; Mitchell 2002; Latour 1996) and often through the insertion of technology designed "to do the work of technocracy" (Riles 2004, 393). This recursive process entrenches the technocratic logics that have led the intervention to hit against its limits in the first instance (e.g., Venkat 2021) causing failure to be a commonplace occurrence rather than a rare oversight (Mosse 2005; Ferguson 1994). It is therefore worth attending to the nature of knowledge produced through the technocratic method (K.A. Mason 2016b; Merry 2016, 2011; Riles 2004; Knorr Cetina

1999) that stakes its claims in science as “the ultimate arbiter of ‘truth’ in modern societies” (Greenhalgh 2008, 9; see also O’ Reilly 2017; Kuhn 1970[1962]).

The technocratic approach may produce its own limits, but its use of numbers and statistics also produces the kind of data that forms and informs epidemiological imaginaries (Reubi 2020) that drive global health initiatives. This further promulgates these programmes and the technocratic techniques upon which they are based (Lorway 2017; Sullivan 2017; E.L. Fan 2016). But with failure a commonplace occurrence, anthropologist Elanah Uretsky (2017) encourages us to ask: whom do these technocratic programmes, protocols and techniques benefit? For whom are they designed? (see also e.g., Storeng and Béhague 2017; Wendland 2010). Attending to moments of ‘slippage’ (O’ Reilly 2017), breakdown (Star 1999) or even, as theorised in this thesis, *maodun* (矛盾; contradiction) offers a mode of enquiry into how things operate within a technocratic programme.

Finally, sociologist Susan Leigh Star alerts us to the fundamental influence of ‘boring things’, such as infrastructure that becomes abruptly apparent when things don’t work so well (1999). These non-humans are usually in the background, imbricated in human planning and organisation, facilitating operations, and going unnoticed. However, as in the case of infrastructure, its design is set and things become “more complicated when one begins to investigate large-scale technical systems in the making, or…examine the situations of those who are *not* served by a particular infrastructure” (Star 1999, 380 author's emphasis). Infrastructure is relational and what’s missing for one person may be sufficient for another. We may ask, in what ways do its design preclude and exclude, as well as include? A sensibility towards what’s not there enables us to grasp the influence of the invisible. Indeed, in the chapters that follow, I explore the invisible extant in health professionals’ daily enactment of Shanghai’s DOTS programme, and the ever-present but often unattended to influence of non-humans in the co-production of technocratic knowledge and shaping of tuberculosis control.

CHINA AND THE TECHNOCRATIC

I draw on literature from the history of science, sociology, anthropology and Asian studies to anchor my understanding of China’s historical, political, instrumental and even aspirational engagement with the technocratic from the Maoist period to the present day. The use of numbers and statistics as an objective and universalist way of

measuring, knowing and comparing the social world is central to the technocratic approach (see previous section). Historian Arunabh Ghosh has shown that, far from being universal, this assumption that first emerged in the 1950s was not always everywhere accepted, however. In his work on the early People's Republic of China (PRC), Ghosh demonstrates the entwined nature of statistics and statecraft and how "the acceptance of even the most basic statistical ideas and concepts is contingent and contextual" (Ghosh 2022, 2). Chinese statisticians and economists at the time, all trained in elite institutions nationally and abroad, embraced the use of 'socialist' statistics and both rejected and criticised what they deemed the 'bourgeois' statistics that were emerging from the U.S.

Their objections were rooted in ontological and epistemological grounds. The bourgeois statistics incorporated the use of mathematics and applied chance and probability to the statistical analysis of the social world. This was antithetical to communist sensibilities. Marx had already defined the stages of social change and there was nothing random about the study of society. Moreover, while mathematical statistics boasted universality, the Chinese communists insisted on the importance of context, particularly that of "real-world economics and political conditions" (Ibid., 4). A universalist approach whitewashed the variety of conditions across which people lived – most importantly, the disparity between the bourgeoisie and the proletariat – and thereby conveyed an inaccurate representation of reality. The use of bourgeois statistics was therefore unsuitable for a socialist society. Rather, the Chinese employed exhaustive enumeration and collected numbers en masse to know about society instead of extrapolating from random sampling. However, with the PRC still in its early stages, the country did not have the necessary infrastructure to support this kind of surveillance and reporting, which stymied the efficacy of this ideological approach (Ghosh 2020).

Sociologist Joel Andreas has explored China's deliberate choice to turn towards the technocratic and how the country came to be governed by a committee of (red) engineers following the Maoist period (Andreas 2009). Andreas cogently demonstrates how this outcome arose from the "contention and cooperation between a new political elite and the old educated elite" (Ibid., 4). The New Class in China emerged through these decades-long relations between the Communists and the denounced bourgeoisie who had been dispossessed of property and business(es) and marked by their elite education. He argues that, rather than the complete denouncement of the bourgeoisie, the Communists failed to do away with class difference, as propounded by Marx, and instead abandoned this failed tactic to pursue a pragmatic technocratic alternative predicated on a hierarchical structure with

a ruling, educated elite. Following a tumultuous series of events, including the largest famine in human history (C.D. Brown 2012), that left the country struggling with poverty and internal conflict, Mao launched the Cultural Revolution with the intention to wipe out any opposition to his sole rule over a class-levelled population. Instead, his campaign brought the Party and the old-educated elites together to overthrow his attempted takeover and at the death of Mao,

> Party leaders renounced class-levelling, unambiguously recognized the value of cultural capital, embraced the old educated elite, and moved to transform the CCP into a party of technocrats. (Andreas 2009, 273)

Interestingly, the work of historians Xiaoping Fang (2012) and Miriam Gross (Gross 2018, 2016) has also traced this continued contention and collaboration between the Communists and the old educated elites in the area of public health medicine during the Maoist Period. Whereas Fang has shown that the barefoot doctors (赤脚医生; *chijiao yisheng*) were pivotal in introducing western medicine to the rural setting rather than consolidating Traditional Chinese Medicine (TCM),[6] Gross has demonstrated how this would not have been possible without enlisting the cooperation of the old educated elite. The denounced bourgeoisie were sent to the countryside for re-education, with some having been trained in western medicine in prestigious institutions both abroad and within China. In contrast, the barefoot doctors were peasants with little education and basic medical training. Gross argues that rural barefoot doctors could not have instilled the effectiveness of western medicine without the assistance of the denounced physicians from the cities.

Since installing a committee of technocrats at the ruling helm at the onset of the Reform Period in the late 1970s, China has not looked back in taking up, promoting and proudly pushing forward in the "scientization and technocratization of the regime" (Greenhalgh 2008, 5) for the modernisation of the country. Anthropologist Susan Greenhalgh has examined China's One-child Policy as one of the earliest examples of Chinese "scientific policymaking" (Ibid.). The infamous population control programme was intended to engineer the country into a "modern, global power *through selective absorption of Western science and technology*" (Ibid., 3 author's emphasis), as informed by the discipline of cybernetics.[7] Controlling

[6] Barefoot doctors were rural villagers who had undergone informal training in basic first aid and preventative medical treatment. These individuals usually possessed basic primary education and the correct political credentials (Fang 2012, 27) and were farmers who laboured barefoot in the paddy fields when not on duty. These "rapidly trained and cheaply paid paramedics" (Gross 2018, 340) brought healthcare to the rural masses during Maoist China.

[7] Cybernetics is the study of complex systems of control and communication, primarily in computer science but its principals have also been applied to other areas, such as behavioural sciences.

population growth was forecasted to achieve an economically wealthier China through the creation of “a high-quality, competitive workforce and a modern citizenry befitting of a global power” (Greenhalgh 2010, x). It was to decrease the number of people so as to increase the *suzhi* (素质) or ‘quality’ of citizens and, in effect, that of the country through technocratic logics of governance.

The scientific policymaking approach has continued throughout the 2000s and persists in the present day. Health professionals’ training in and daily enactment of technocratic public health programmes (as discussed in the previous section) entangle the idea of science and technology as markers of modernity with their own subjectivity and aspirations. Medical anthropologist Katherine Mason’s (2016a) research with health professionals working in a CDC in south-eastern China discusses her interlocutors’ aspirations for a transnational scientific common (TSC) that, for them, represents the apex of scientific objectivity and professionalism. She recounts the extent they go to gain acceptance and membership into this imagined scientific commons and of the disdain and frustration they felt towards local public health work conducted through relations rooted in *guanxi* (关系; Chinese term for social networks of influential relationships). Her interlocutors feared that continuing in these ‘traditional ways’ sabotaged their ability to develop themselves and stated that “only a *guanxi*-free professional common” (Ibid., 69) could ensure the safety, protection and preparedness necessary to manage modern-day health threats, including the always anticipated pandemic-to-come. They expressed their desire for “scientific imaginaries” (Ibid., 107) that referenced an ethical, orderly, objective and professional West that reflected back their own ideas of self and achievement.

Anthropologist Priscilla Song’s work explores how Chinese health professionals link their own aspirations and achievements with those of the nation. Her research examines how the hope for cure instilled in ‘cutting edge’ medical interventions converges disparate groups of scientist-clinicians, business entrepreneurs, and hopeful patients and their loved ones from around the world who wouldn’t come into contact otherwise (Song 2017). Enabling this convergence are the Chinese clinicians who become globally sought after by foreign patients for their experimentations in biomedical technologies. These medical entrepreneurs are not just interested in making money, but also in the pursuit of “professionalism and nationalistic pride” (Ibid., 19) or what Song frames as technonationalism – as she quotes one commentator, “’they will without fail create even more glory and splendour’ for ‘China and the world of medicine’” (Ibid., 108).

A recent edited volume by Susan Greenhalgh and Li Zhang explores this purported confidence in the entanglement of science and technology and political governance to generate the "national revival and global ascent" (Greenhalgh and Zhang 2020, 1) of China. They and the contributing authors examine various sides of the technocratic measurement and management of public and mental health in China. Greenhalgh proposes an anthropology of Chinese science and technology, an area that would include research, amongst others, demonstrating the market commodification of subjects of care vis-à-vis the technocratic demands of global health interventions (E.L. Fan 2021); the paradoxical "price of free" (Dirlikov 2020) in diagnosing tuberculosis; how evidence and efficacy are negotiated in experimental medical therapies (Song 2020); the constructive role played by numbers and surveillance in mental health programmes (Ma 2020); the provision and imposition of *guan* (关) or care for mental health patients (Zhu et al. 2018); the politics of *guanai* (关爱) or 'care and love' in a methadone programme (C. Zhang and Song 2020); and the "aesthetics of statistics" in HIV control (Hyde 2007). These studies all investigate highly technocratic (global) health programmes implemented in China. Their design upholds international standards that render these interventions recognisable as modern health programmes and Chinese health professionals as experts capable of enacting them. My thesis joins this area of research by examining how China, and specifically Shanghai, enacts the technocratic through DOTS in managing tuberculosis.

FIELDSITES AND METHODOLOGY

Figure 1: Building One of the SCDC, where the municipal Department of Tuberculosis is located. (Source: https://www.sohu.com/a/417055032_120823584)

This thesis is based on fourteen months of fieldwork conducted between January 2014 – March 2015. As tuberculosis control is managed by the Shanghai Centre of Disease Control and Prevention (SCDC), I interned with the Department of Tuberculosis within the SCDC throughout this time (Fig. 1). The SCDC was established in 1998 and is based on the US CDC model (see Chapter One for more on the historical development of public health in China and tuberculosis control in Shanghai). Its creation combined multiple pre-existing institutions into single divisions to resolve function overlap and increase efficiency (S.N. Zhang 2003). The Department of Tuberculosis is within the Infectious Disease division and under the Department of Communicable Disease Control and Prevention, which includes the municipal microbiology laboratory and the strain and sample bank (Table 1).

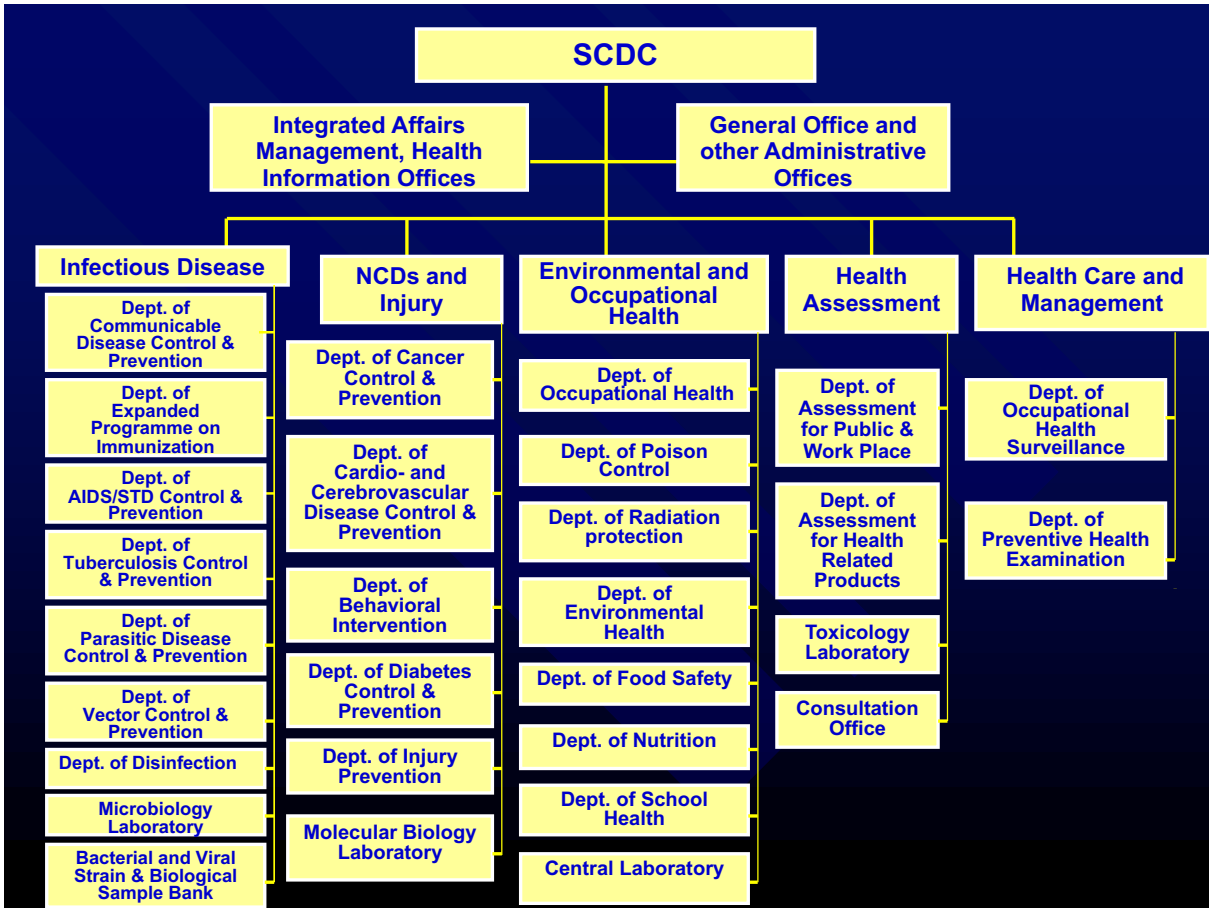

Table 1: The SCDC public health model and its sections, divisions and departments (SCDC 2011).

The SCDC is part of a network of municipal partnerships and collaborates with clinical expertise, academic researchers, preventative health staff in the district and community levels, and the Municipal Health Bureau, now called the Family Planning Commission (Table 2). It is funded by the National CDC in Beijing, established in 2008 after the SCDC, and decides the allocation of funds to all district CDCs as well as the preventative health departments in community health clinics. Clinical funding for designated hospitals and general hospitals comes from the Family Planning Commission, and university funds are not provided for by the healthcare system.

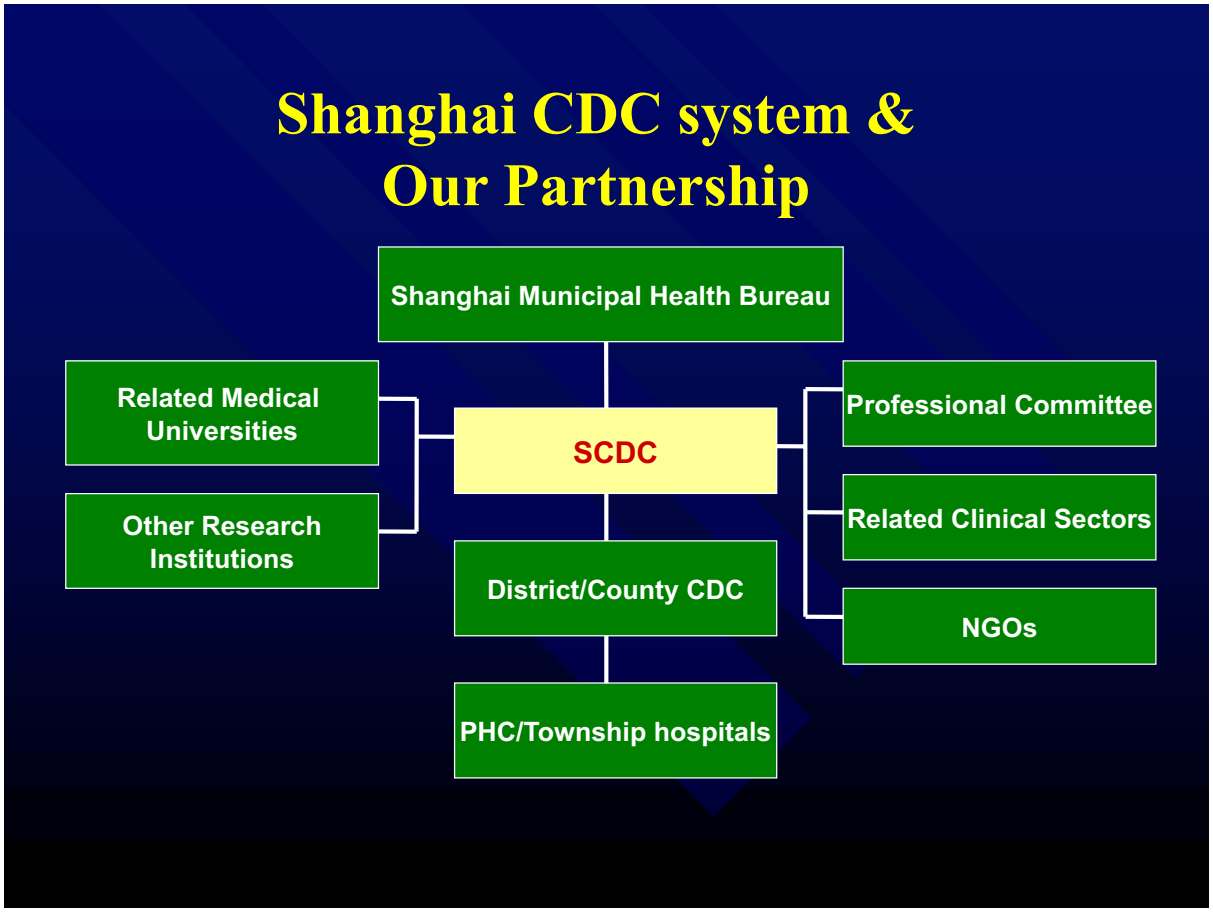

Table 2: The SCDC and its partnerships (SCDC 2011).

I was permitted to carry out research at all three levels of the three-tiered health system. This permission was fundamental as the Shanghai tuberculosis control programme (STP) spans vertically through all three tiers and horizontally across each level. This made my research necessarily multi-sited and I was fortunate to have the opportunity to learn from health professionals positioned at crucial interstices in the STP. These interstices were located in the municipal administrative offices; the municipal microbiology laboratory; three district CDCs; five designated hospitals within those districts; and three community health clinics in three different districts. Each level served a different function in the STP machinery, and each space was distinct from another in the same category due to the specificities of each district, community, and workplace ethos, among other variables. These fieldsites also spanned the city. Travelling to each of these sites, and even figuring out the public transportation system to get there, helped me learn how to physically navigate the diverse terrain. The variety of professional contexts I was exposed to taught me how to understand and engage with the multitude of lives and lived realities I encountered and that co-exist together and yet separately within the metropolis (see Chapter One for more on Shanghai the city).

I began fieldwork as preparations were being made for the end of the year. That meant attending some of the year-end shows performed by staff in each fieldsite, a lot of Chinese New Year banquets where I met some of the health professionals I would later work with, and conference meetings for summarising the year's achievements and laying out the next year's work plan. My research primarily comprised participant observation and semi-structured interviews, and my first posting was in the administrative offices of the SCDC Department of Tuberculosis. These housed the epidemiology section, patient-monitoring section, microbiology section, financial section, and the director's office. I spent three months here and my duties included attending meetings; presentations; collating information for World TB Day publications; accompanying municipal staff to the off-site monthly MDR-TB consultations (see Chapter one for more); arranging for two historians of medicine to present their work on the history of tuberculosis in China to the municipal staff; and learning about how the STP policy worked.

For my interlocutors, I was the first anthropologist they had met. They themselves were epidemiologists, microbiologists, public health practitioners and graduates, and a former clinician. And they were curious as to how tuberculosis control could be relevant for anthropology. I was asked to give an introductory presentation of who I am, what anthropology is, what my research interests were, and my methodology for collecting data to address my curiosities. I believe it gave people a better understanding of me and my purpose there. I received their unanimous response that it is much harder to understand tuberculosis and its control qualitatively than quantitatively. Every health professional I met acknowledged that tuberculosis is a social disease of inequality, and that policy did not sufficiently address this social-economic dimension. One interlocutor expressed this sentiment and also opined that my work ought to be helpful. He believed firmly that research should be constructive and not just critical for critique's sake. I find merit in this comment, no matter the disciplinary approach.

During this time, I also had access to the municipal microbiology laboratories, housed opposite in Building Two of the same complex. Here, I spent time with the tuberculosis laboratory technicians who carry out drug-sensitivity testing (DST), quality control for sputum smear testing, and microbiological work for national and municipal research projects. It is also where the solid medium used for culturing *mycobacterium tuberculosis* for DST is made using an abundance of chicken eggs for protein. Here, I was taught the rationale for biosafety and infection control. I was initially struck by the contrast between the laboratory work environment and that in the administrative offices. The administrative offices were hushed spaces, where everyone attended to

their own work on their own computer screen within their own cubicle. In the laboratory office, the technicians sat together in one office room with no partitions and there was constant conversation and discussion. This was also the case in the biosafety laboratories where live bacterium is handled (see Chapter Three for more). The technicians worked together to achieve their tasks, be it DST, preparing a presentation, or organising a training session for district personnel. I found the space and its inhabitants warm and welcomed the more sociable ethos, having already worked in a partitioned cubicle myself for a month by that stage. During my period in the municipal laboratories, I was permitted to enter the biosafety level three (BSL-3) laboratories in which live bacterium is handled, observe how culture medium is made in bulk, as well as meet other laboratory technicians hired for adjunct positions and university students carrying out research for their PhD projects.

Next, I was stationed at three different district CDCs for three months. These were once again administrative offices with individual cubicles but the atmosphere was less hushed and more informal. Here, I attended meetings, trainings, visited neighbourhood committees to enlist their support for mandated projects, and learned of how reimbursement, surveillance and patient follow-up operated at this level for entire districts. I observed how general guidelines for projects become adapted for local conditions and implemented in specific settings. The health professionals at this level engaged with both clinical doctors in the designated hospitals and preventative health doctors in the community health clinics, and managed their duties accordingly.

The practicalities of outbreak monitoring and follow-up work were also managed by staff at this level. Personnel were responsible for identifying and managing outbreak situations, say, for example, in universities, and ensuring the screening of close contacts and the testing and disinfection of the entire site. There were infrastructural discrepancies between the different district CDCs. Some buildings and offices were small and basic in comparison to others that boasted big windows and bright rooms, with lunchtime yoga classes and badminton courts. Friendly annual competitions (but no less competitive!) are held between all district CDCs to foster and maintain collegial comradery and I participated in the lakeside running event held that year.

During these three months, I was also permitted to spend a total of six days observing in two designated hospitals and one day at a community health clinic. I also spent three days observing in the main third-tiered hospital for treating tuberculosis in Shanghai, the Shanghai Pulmonary Hospital (SPH). In the hospitals, I was permitted to sit in on outpatient consultations and spend time on the inpatient wards. Fieldwork in

this space mostly consisted of shadowing and observation as the clinical staff were too overrun with work to interview or give lengthy answers to questions. In the community setting, I was stationed in the preventative health section of the community health clinic and due to the slower pace, was able to converse with as well as observe the work of these health professionals.

I took a month's break to process and reflect upon all I had learned in the previous eight months. I also took the time to identify which areas I needed to examine more and plan how to spend the rest of my research time. I then spent the remaining five months working with a community health doctor in one community health centre only. I also made weekly visits to the second main hospital for tuberculosis treatment in Shanghai, the Pudong Pulmonary Hospital (PPH). I had by that stage traversed the entire STP and learned about the roles and responsibilities of health professionals across three levels. Concurrently, I had attended some, not all, trainings and conferences that were frequently organised. This five-month period was therefore an exceptionally rich time for me, spent getting to know a group of public health professionals well in terms of their work but also their outlooks, experiences, aspirations and frustrations. I was permitted to accompany and observe patient home visits (some of them the crucial first contact meeting [see Chapter Five for more]), study reimbursement files, enquire into how other preventative health streams are managed (such as hypertension and diabetes), observe how the social space of the community health clinic (CHC) operates,[8] and learn about the other services the CHC provides and projects the preventative staff were carrying out for measuring issues such as malaria and levels of air pollution. Having more time here meant that I could explore patient cases more deeply, as well as how health professionals made sense of and responded to the instances of lived realities for which they were responsible. I gained insight into how these individuals conceived of their position within the community as the most direct interface with patients in the whole STP. I found this community warm and generous, treating each other with a professional collegiality and informal familiarity that comes from working together for many years – some had worked there for over two decades.

The data I collected was recorded in the form of shorthand notes written while carrying out participant observation during the day; longer-form fieldnotes and reflections written in notebooks in the evening; recorded fieldnotes; official policy

[8] The CHC is predominantly a clinical space with wards and immunisation centres. It receives most of its funding from the National Health Commission, with the preventative department receiving additional funds from the SCDC.

papers; tuberculosis-related paraphernalia produced by the SCDC and district CDCs for raising awareness; digital photographs, although these were limited for ethical reasons (see next section) and mostly of objects rather than people. I subsequently transcribed and indexed the recordings to facilitate my analysis of the main themes.

I had to end fieldwork abruptly due to personal reasons and it was necessary to go on interruption of studies for some time. These fieldnote inscriptions were invaluable for my returning to the thesis after the extended time away (see the Reflexive Reflections section) and, in particular, I marvelled at how listening to a recording of an interview or a moment during fieldwork, even the background office sounds, instantly brought me back in time to the scene. I came to appreciate sound as a powerful medium for eliciting memories and, in the absence of visuals, one that foregrounds the details of not only what is said but also how it is expressed and the wider context in which instances of sonic sociality and "the complexity of 'sound milieux'" (Guillebaud 2012, 317) take place.

This brings me to the consideration of time and memory in the writing of this thesis. I address this issue as I have had to come back to my research at a later point, albeit with more experience of healthcare and its management in Shanghai under my belt. In re-reading and re-listening to my data, some parts felt like I was learning about them again for the first time, with my memory of the moment sharpening into focus as I read/listened on. I also noticed that I could detect the sub-text and more subtle inflexions that denoted wider meaning in the moments I captured in notebook and recording. It has been necessary for me to live in Shanghai, the place of my fieldwork, since I had to go on interruption of studies and for the writing up period. As a result, I have, over time, gained a fuller sense of social life here and its norms and nuances, including a greater appreciation of what it is to seek out healthcare and how it is to live under the stringent enforcement of public health logics for infectious disease control vis-à-vis China's anti-Covid measures. In this way, I can see that the experiences and understanding I have gained from residing in and negotiating the city of my research now inform and contribute to my closer reading of the data I took pains to record at a different time, when I had not yet encountered all that I have.

I therefore acknowledge that what comes in the proceeding chapters is, at least in part, informed by the perceptions and values I have come to practice and hold since the research was carried out. These have compelled me to attend to my data in ways that take particular trajectories of analysis. Anthropologist Michael Taussig writes of (fieldwork) notebooks holding a 'potential' and a 'mystique' – as "documents that blend inner and outer worlds" (Taussig 2011, xi) that are vehicles for conserving

knowledge “not as an inert record, but as something quite different, something alive” that he refers to as “a *type of knowing*” (Ibid., xii). This quality of ‘aliveness’ and mystique is co-produced with the anthropologist, who is “an individual full of (hi)stories, contingencies, and subjectivity, who nevertheless struggles to bring an ‘objective’ account of what happened under his or her eyes” (Polleri 2017, 9). This is true whether the anthropologist is writing on research freshly carried out or returning to it after a time. It is possible to attend to only a limited number of things at any given time when conducting fieldwork, with the beginnings of these selections having already been put in process before the anthropologist enters the field through the writing of research proposals for academic or funding purposes (Taussig 2011) and all the theory and methodological practicalities that need to be ingested, considered and adopted for a project to be viable. Fieldnotes are the inscription of these selections, further honed by the researcher’s presence and person. Memory, therefore, is always partial, being comprised of both forgetting and remembering, with “the present construct[ing] the past even when technology as mnemonic devices capture the whole of memory” (Haripriya 2020, 80), such as digital recordings with background office sounds and all. What is remembered and written about by anthropologists is also always political as the individual’s presence and person filter attention and frame events. This thesis is a product of the past and the present converged through a selection of inscribed ethnographic facts.

ETHICAL CONSIDERATIONS

It is through negotiating one of the major ethical issues that arose that I began to think of the SCDC, the institution itself, as an interlocutor to whom I have an ethical responsibility. During the first month of fieldwork, I had many conversations with health professionals comparing our respective disciplines to better understand the similarities and differences. I mentioned that my research would be written up in the form of a single-authored thesis. This irked my interlocutors, who were used to research being a team effort and the write-ups that stem from these collaborations as multi-authored pieces of work. They could not understand the reasoning behind single authoring and pointed out that I’m not actually doing the research on my own. Rather, it was only possible due to the SCDC giving me permission to access and observe their work, to learn from staff, to accompany patient home visits, to access and explain their files and online surveillance platform, to even set foot in any of the institutions, hospitals and clinics where I would gather data. In fact, without their permission and cooperation, I wouldn’t be able to carry out the research project I was there to do. They added that my fieldwork and subsequent write-ups and publications

are the product of our collaboration rather than my individual efforts. My interlocutors also advised that I should speak with the departmental director about this issue as there may be intellectual property constraints that need to be clarified. I gratefully took their advice and spoke with the director who confirmed this line of logic and that the SCDC would expect to co-author, vet, adjust and even veto any work that transpires from my research.

My first reflex was to want to assert my academic freedom and not have to be answerable to an institution or have to write to their priorities and motivations. In the course of our meeting, the director had made it clear that the SCDC is a state body that must attend to its reputation, what kind of material it is associated with it, and how it is portrayed through the public dissemination of this information. Having listened to how other health professionals had found the idea of single authorship strange and heard the director's explanation for how they must, essentially, care for the SCDC's reputation and image, my interlocutors helped me to see another position on the issue. Although I had exercised considerable ethical reflection on the safety and well-being of my human interlocutors, I had not done the same for the SCDC itself, which I had come to understand as an entity that had much at stake in terms of its reputation and public image. If I would seek out my human interlocutors to ask whether or not I had correctly represented what they had shared with me before a publication, then why would I not do the same for an institution that had, indeed, opened its doors to me in the spirit of collaboration for a common cause: to control tuberculosis? I realised that my initial reflex was based on an inconsideration toward the SCDC itself and was grateful to my interlocutors who had helped me to shift my perspective and see the issue from another position.

I subsequently met with my supervisors, shared what had happened with them, and my revised stance. They understood but also pointed out that single authorship of doctoral dissertations in anthropology is a requirement as set by the university. I went back to the director to inform him of this regulation, and we came to an agreement. We signed a document that stated that I could single author my dissertation with appropriate acknowledgement of the SCDC's role in the research process. I could also single author later publications but would first have to share it with the SCDC and attained their sign-off, as well as properly and sufficiently acknowledge their role and contribution to the work. I found these terms fair and was grateful to my interlocutors for offering me another perspective and working with me to seriously consider and negotiate how to resolve this issue satisfactorily for all parties, including for the SCDC itself. It also broadened my consideration of who our interlocutors are and the unconscious bias I'd had towards large institutions that

coloured my understanding of who is vulnerable, to whom we have an ethical responsibility, and to what extent.

The SCDC is a state institution and its employees are considered civil servants, as are all health professionals in China. As such, these individuals and their actions represent the government and they are responsible for the above-mentioned reputation and public image of the SCDC. These people were also my interlocutors and shared with me their personal experiences and insights of working within in this setting. In order to maintain their anonymity, I choose to use composite characters throughout the thesis. Each character and voice that populates this thesis is a blend of multiple characters and voices. I use this method because my internship with the SCDC was organised and managed by the institution. The director for the Department of Tuberculosis was open and receptive to my research interests and my requests for what and where I'd like to learn about. However, where I was stationed within the system – which district CDC I visited, which community health clinic, which department of which hospital – was known by many. This was necessary for me to have access to the fieldsite and to be permitted to conduct research in what were essentially restricted areas for medical personnel only. Pseudonymisation as anonymisation is therefore insufficient in this instance and I have written elsewhere on the thinness of this method to preserve anonymity due to how research is carried out and later written about in context (Shum 2010). It is also for this reason that I include few images of my fieldsites and their inhabitants as these would identify my interlocutors in their place of work. Instead, I provide textual portraits of some of my interlocutors in the form of interludes at the interstices of chapters. I seek through these textual sketches to capture and convey who these individuals are and how they negotiate(d) their personal, social and ethical lives in situ. Read alongside the chapters, these interludes also offer a richer sense of Shanghai as a place through time.

I conducted exit interviews with each interlocutor before leaving each fieldsite. I chose to voice record these semi-structured interviews solely for note-taking purposes and for my ears only. I initially sought consent by presenting my interviewee with a document listing my purposes for recording and that their anonymity would be maintained unless they stated otherwise. Again, my interlocutors are civil servants for a state institution and I observed that the act of asking them to sign their name to a document caused them concern, with subsequent conversation becoming stinted as a result. I then shifted to using verbal consent by which I informed them of my reasons for recording and how the data would be managed. If they consented, then I started the recording and, otherwise, I would not record. I noted that interviewees were more

at ease with this form of consent-giving. Not having to sign their name to a material record of what they have said that is tangible evidence of that conversation was more acceptable to these civil servants who understood that I would preserve their anonymity. Director Mei did not see the need for his name to be anonymised as much of what he shared with me was already well-known or information he believed should be disseminated, and so I use his real name.

REFLEXIVE CONSIDERATIONS

Different and Familiar

To my interlocutors, I represented multiple things. Both my parents are Chinese, my mother from Shanghai and my father from Hong Kong, and I was born and grew up in Ireland. I physically look Chinese and when I speak, my accent is a mix, I've been told, of Mandarin spoken with a Cantonese/Dublin twang. These characteristics place me firmly in the category of *huaren* (华人; foreign citizen of Chinese descent or overseas Chinese). I occasionally heard people referring to me *waiguoren* (外国人; foreigner) or *laowai* (老外; literally 'old outsider'). To everyone who met me, I was affiliated with the municipal SCDC and had been given permission by that office to conduct my research. At the same time, I was a student and there to learn from experienced experts. I was not from their field but from a discipline they had not heard of before that investigated the how and why of what humans do rather than the medical and microbiological. My interlocutors knew of the University of Edinburgh and, more generally, would ask me how things are over there on 'our' side? (你们那边怎么样?; *nimen nabian zenme yang?*). We also discussed my 'Chinese-ness' and the commonalities we had in terms of values and upbringing, such as the importance of filial piety, its dwindling occurrence in contemporary society, and gender expectations. For my interlocutors, I occupied an in-between space. They perceived me through different permutations of these characteristics, in varying concentrations, but being a *huaren* precluded me from *only* being from here or there. I am from both here and there and not fully from either place. The multiple ways in which my interlocutors made sense of me and my purposes affected how they acted towards me, the relationships we developed (or didn't), and the conversations we had (or didn't have).

Hua (华) refers to China and *ren* (人) means person. *Huaren* is therefore a political designation with a racial component that serves to remind and bind the country's people together, be they near or far. Personally, in 2014 during my fieldwork, I experienced it more as a marker of socio-economic difference rather than as a signifier of solidarity. This term is in specific reference to the previous generations of Chinese that had emigrated in search of jobs and better livelihoods in other countries. They had set up businesses, had families, and many were successful. A part of this diaspora had already returned to China by 2014 and these returnees were generally regarded as being somewhat economically better off than their local counterparts having made their money abroad; as being more 'open' due to their having spent sometimes decades living away; and their children are usually educated internationally, either having grown up abroad or through attending boarding school after their parents had returned to China – sending ones children for education abroad was and still is an aspiration for many Chinese parents. *Huaren,* then, in colloquial parlance, is a designation for a certain socio-economic standing assumed by those who had not left, even though the variety of *huaren* experiences is many. Moreover, my father being from Hong Kong added another layer of socio-economic and political complexity, with Hong Kong having long been the financial centre of China and most liberal in adopting 'Western' ways.

In many ways, I represented the 'other' to my interlocutors, albeit the accessible 'other' in-between with my foreigner twang and familiar values. As we became more accustomed to each other and forged relationships, some of those now long-term friendships, there remained a distance that both distinguished and drew us close. During fieldwork, I believe that distance allowed my interlocutors to share insights with me in candid ways that may not have been possible, perhaps, if I was deeply embedded within the local. They are civil servants and state representatives and are obligated to maintain a certain *biaomian* (表面) or appearance towards to the outside and outsider. However, these individuals also divulged information and opinions that were personal and gained through experience, even if they did not maintain the beautiful outer appearance (完美的表面; *wanmei de biaomian*). Interlocutors from the district and community levels shared their thoughts on issues they only reported favourably on to their superiors. And yet, I represented the municipal offices. I was both from the municipal offices and somewhat outside of the whole system.

The combination of SCDC authorisation, my status as a doctoral student, and my university from abroad gave me the legitimacy to be in their space. Perhaps it was all the rest that enabled them to speak openly about issues they'd wanted to speak

about. My simultaneous familiarity and difference presented an occasion in which the usual rules were suspended, and perhaps the anonymity I ensured allowed my interlocutors to express their opinions on public secrets (Geissler 2013; Taussig 1999). I also asked different kinds of questions – ones not based on numbers nor indicators – and oftentimes didn't ask anything but allowed the individual to lead the discussion. Instead, I listened, and was told explicitly by my interlocutors that they hoped I could assist them with these issues or relay the information to those who could – I do not presume that I can achieve these things although I try my best to represent their concerns in the following chapters. My interlocutors as a group expressed these concerns ambivalently – some did so with frustration, others with hope, still others in dejected tones – but what was clear was that they were very aware of the issues at stake.

My being in-between also meant that I made mistakes and social *faux pas*. These usually came in the form of misreading social cues and hierarchy, or not understanding technical terms or protocols. My interlocutors graciously chalked it up to my *waiguoren* or *laowai* ignorance and did not take offence. They would instead explain to me what had just happened or what had been meant, and these moments of clarification offered opportunities to explore that which is taken for granted. My interlocutors granted me that privilege, again, because of my in-betweenness, being both different and familiar.

Personal Shifts

Between carrying out this research and writing up the final thesis, I spent many years caring for a vulnerable patient and engaging with healthcare practices and policies. Concurrently, I have experienced three years of anti-Covid measures in China – the measures taken here have stretched public health logics, ethics and imagination to their full extent, I would argue, and then stretched them some more (see the CODA for more). Through these experiences, I have bore witness to and come to experience how health policies and practices come to objectify and even dehumanise patients through the same processes of aiding them. The logics that inform these processes are robust and, at times, they can seem impenetrable. They are unwaveringly technocratic, with the elitism of scientific knowledge and technical expertise trumping any point a layperson could counter. However, it has also been my experience that whether or not a point can be heard invariably depends on the individual health professional one is dealing with. I explore these themes in the chapters to come.

As I write of the interstitiality of my interlocutors, I also acknowledge my own interstitiality in the formulation of this writing. In addition to my original research interests, my subsequent experiences have made questions around how health professionals cope with the everyday practices of objectification and dehumanisation when dealing with the treatment and recovery of vulnerable people interesting to me. How do public health professionals, who manage population health rather than a person's health, deal with the emergent effects of their efforts? How do they enact care and healing through their duty to perform acts of abstraction and disengagement? Indeed, how do they look past the social and economic when managing a profoundly social disease such as tuberculosis? And, as before, how do their understandings and efforts shape the outcome of public health work? In a way, these questions investigate how a balance is struck between how public health programmes think and how health professionals work through, and sometimes in spite of, protocols in caring for patients.

THESIS OVERVIEW

The following gives an overview of the main themes and arguments I present in the chapters to follow. As well as the six chapters, I have interspersed four interludes with health professionals who have worked at different times and in different capacities in controlling tuberculosis. As mentioned before, these textual portraits at the interstices of chapters One and Two, Three and Four, Five and Six, and Six and the Conclusion seek to capture and convey who these individuals are and how they negotiate(d) their personal, social and ethical lives in situ. They also offer the reader a richer sense of Shanghai as a place through time.

Chapter One, entitled *Shanghai and Tuberculosis Control, Then and Now*, functions to situate this thesis historically and socially in the Shanghainese context in which its version of DOTS is being carried out. It does so by first giving a broad outline of the historical and political development of public health in China that provides the backdrop within which tuberculosis control efforts were made in Shanghai; these endeavours were likewise fundamentally affected by the country's turbulent twentieth-century political history. The political lens is also important for highlighting why China chose to reform its public health system to adopt the CDC model of public health management, which was born from military and technocratic origins. The second section outlines how the STP operates by following an individual, a migrant worker named Liu Wen, as she is newly diagnosed with tuberculosis and enters the public health programme. Her personal economic circumstances and social status

play a fundamental role in her ability to access healthcare and pursue recovery. The final section aims to illustrate some of the lived realities faced by migrant workers as they make up the majority of tuberculosis patients in the metropolis. Their challenges are determined in a large part by the issue of household registration or *hukou* (户口) and its control over rights and entitlements vis-à-vis state support and services.

Chapter Two introduces the group of professionals who make tuberculosis knowable and, therefore, controllable in Shanghai. *The Laboratory Technicians* examines the pivotal position occupied by these experts who, within the DOTS system, are the ones who can officially confirm a diagnosis of tuberculosis. What sets them apart is that only they can see the microbial infective agent: *mycobacterium tuberculosis*. It is this act of seeing that constitutes knowing, with the patient only qualifying for entry into the programme and 'free' treatment after having the rod-shaped constituents of their disease observed under a microscope. This chapter explores the central role of technology in how human-microbe relations are mediated, taught, learned and habituated. China's deliberate efforts to demonstrate its increasing ability to possess highly technical and specialised technology, highly trained and specialised personnel to wield these technologies, and protocols that conform to international safety standards are also a public assertion of its standing as a modern state.

Chapter Three explores how health professionals understand the subject of their efforts. It begins with the opening question: what is tuberculosis? Whereas the previous chapter focused on human-microbe relations through the expertise of laboratory technicians and in relation to *mycobacterium tuberculosis*, this chapter draws on the perspectives of health professionals at the municipal, district and community levels and how they regard the disease, tuberculosis, itself. *The Microbe Multiple* examines the various ways in which health professionals speak about (discourse) and act towards (practice) tuberculosis. It draws on philosopher Annemarie Mol's work in *The Body Multiple* (2002) and finds that, rather than a singular entity, tuberculosis would seem to constitute multiple things, as its microontology (Hird 2009) is understood and acted upon in multiple ways. 'Tuberculosis', then, is a signifier that health professionals use when they wish to speak about the disease in singular and universalistic terms. In practice, however, variants of tuberculosis can cohere and co-exist together, even if they contradict each other, depending on how much work is done to coordinate and distribute their variability. The final section examines how health professionals make sense of the friction caused when incommensurable variants of microontology do clash.

Public health surveillance is often considered the cornerstone of public health work. Chapter Four examines the use of numbers and statistics as technocratic forms of knowing and knowledge production through the lens of finance. The STP stipulates that 'free' treatment constitutes the reimbursement of patients for their tuberculosis-related expenditures at the point of cure. This means that patients suffering from a disease of inequality must first foot the bill for their entire recovery, including paying upfront for expensive hospitalisation costs and medications not included in the STP, such as liver protection drugs. They are then to be reimbursed when their treatment is completed. *The Numbers* explores how the surveillance of patients can be directly mapped onto their reimbursement records. Unlike spreadsheets of aggregate statistics, reimbursement records also convey the socio-economic and medical status of patients vis-à-vis their *hukou*, access to public health insurance or *yibao* (医保), ability to afford tuberculosis treatment, and even any co-morbidities they may be concurrently managing. These artefacts, therefore, contextualise patients' experiences of recovery within their lived realities in lieu of stripping them down to objective digits through the practices of indicator culture (Merry 2016). This chapter examines how surveillance work and the primacy of numbers produces 'data inertia' (Ibid., 7) that conjures and perpetuates epidemiological imaginaries (Reubi 2020) in which the socio-economic and political lived realities of patients and their confounding effects are absent.

Chapter Five discusses the labour carried out by health professionals in their daily work to assist patients with their treatment. It focuses on the experiences of community doctors as they are positioned to most directly engage with patients. In addition to following STP protocols, I demonstrate how community doctors exert considerable 'emotional labour' (Hochschild 1983) in their quotidian endeavours to encourage patients to continue and complete treatment. This emotional labour is known by health professionals on all levels as being a vital component in the process of patient management, and yet it is obfuscated and even made invisible through the technocratic design of DOTS and how it measures work and programme performance. *The Labour* examines how audit culture(s) (e.g., Shore and Wright 2015; A.B. Kipnis 2008; Strathern 2000a) and the technocratic fixation on metrics (Muller 2018) has fundamental effects on the production of data and health professionals' ability to makes sense of and carry out their work both practically and sustainably in the context of post-socialist Shanghai. Moreover, the practices of audit culture(s), used to determine health professionals' work performance and pay, generate(s) 'expertise inertia' (Merry 2016, 6) that, together with data inertia (as discussed in the previous

chapter), may sabotage the necessary process of indicator refinement that may be beneficial for tuberculosis control.

Recalling that DOTS is a global health programme, Chapter Six explores the kinds of stories that can and are told through the technocratic language of metrics at different scales of the STP and beyond. In doing so, *Storytelling through Scale-making* examines the quality of scalability demanded of 'modern' health programmes, and the types of data that are produced at each level by health professionals enacting the practices of scale-making (e.g., Carr and Lempert 2016). The kinds of stories that are told are in a large part determined by the kinds of data that inform those who tell them. Drawing on the numbers and narratives produced by the efforts of health professionals, this final chapter investigates the nature of these data as they ascend the scale. The material draws inspiration from anthropologists Vincanne Adams, who considers "number-crunching and metrics work as, in their own way, forms of storytelling" (Adams 2016, 9), and Susan Greenhalgh, who demonstrates how stories or "a powerful problematization can remake the world we live in" (Greenhalgh 2008, 10). Stories told at the local level inform larger narratives broadcast at the national and international levels, such as those of China's rise as a moderniser through its prowess in science and technology (e.g., Greenhalgh and Zhang 2020; Song 2017) and the global health community's continued progress in infectious disease control. These stories and narratives may be based on data that suffers from the technocratic side-effects of data inertia, expertise inertia, and scale-making, as explored in Chapters Four, Five and the present chapter, however. The final section reflects on the nature of realities that are (re)made through storytelling informed by data that may be 'correct' but not necessarily 'true' (K.A. Mason 2016b).

Finally, the Conclusion revisits the main themes and key arguments explored in the thesis and offers some final reflections on the research. A CODA recounts some of my experiences of the extreme Zero-Covid programme in Shanghai and my observations of technocratic Covid control.

Chapter One

Shanghai and Tuberculosis Control, Then and Now

Shanghai had its beginnings as a traditional ‘walled city’ located at the banks of the River Huangpu. The Huangpu River connects the site to a network of inland waterways and to the open sea (Fig. 2), which makes the location an important node for trade both domestic and foreign. This important positioning no doubt contributed to why it was selected as one of the treaty ports following the signing of the Treaty of Nanjing in 1842 at the end of the Opium Wars. The terms of the treaty carved up Shanghai and its surrounding area into concessions for the various victorious foreign powers, with these areas originally going to the British, American and French. The creation of these settlement areas brought opportunities for employment and the population of Shanghai grew rapidly as a result.

Figure 2: Map of Shanghai’s Huangpu River, providing entry from and exit to the open sea. (Source: https://www.shutterstock.com/image-vector/vector-map-city-shanghai-china-1507808801)

Rural labourers flocked to the city to escape the poverty in the countryside, and a local population of around 250,000 in the mid-nineteenth century grew to that of 5 million by the 1949 establishment of the PRC (Henriot, Shi, and Auburn 2018, 1). The foreign administrations constructed financial and institutional buildings along the banks of the Huangpu, particularly at an embankment point known as the Bund, which became the prominent façade of modernity for colonial Shanghai (Fig. 3 and 4). Modern capitalist banking methods were promoted and pushed in this area and the city came to represent the country's financial capital, its industrial centre, as well as its most significant port (Core 2014). I recount this history to draw attention to how these characteristics of Shanghai as a destination for migration and employment and as a centre of finance and cosmopolitanism persist over a century and a half later.[9]

Figure 3: The Bund in the 1930s, showing the financial buildings within the International Concession. (Source: https://www.sohu.com/a/337199658_284489)

[9] Although no longer an industrial centre, Shanghai continues as China's financial capital and one of the country's most important ports as well as one of the busiest in the world.

Figure 4: A 1928 image of financial modernity, as seen from the Pudong side of the Bund. (Source: https://www.geographicus.com/P/AntiqueMap/shanghaibundphoto-1928)

Shanghai continued to grow despite the ravages of the second Sino-Japanese war (1937-1945) and a civil war (1945-1949). After the establishment of the PRC, the Maoists made efforts to tame what had become a cosmopolitan centre of vices and indulgences and to instead transform it into a model socialist city. Today, it is a metropolis of over 29 million people and China's largest urban centre.[10] Almost 40% of the population is composed of long-term migrants, with 80% of this cohort coming from rural areas of China.[11] The post-1979 reform period introduced more relaxed regulations with regard to the household registration or *hukou* (户口) policy, which loosened control of movement for citizens (further discussed later in the chapter). During the Maoist era, citizens were tied to their place of birth and unable to move freely without official written permission. Since the onset of the Reform and Opening-up period in 1978, individuals have become able to travel and reside long-term in other parts of the country as they wish, and Shanghai is a major destination. The metropolis is also home to a large number of foreigners, officially tallied at more than 150,000 in 2023,[12] and prides itself as the country's financial and commercial centre known for embracing the cutting edge as per its centuries-old cosmopolitanism. The colonial Bund institutions on the westside of the Huangpu have been replaced as the commercial core of the city by the Lujiazui Financial and Trade Zone (LJZ-FTZ) built in what used to be rural Pudong (浦东; east of the river). In shiny, LED-saturated contrast, LZJ's iconic Oriental Pearl Radio and Television Tower and global record-breaking skyscrapers stand tall directly across the river. The sight of the juxtaposed old and ultra-modern new sites of commercial power comprises a striking image of the city's temporal continuity as a site of historical, geographical, financial and social importance (Fig. 5 and 6).

[10] This is compared to a population of just over four million in 1950 at the establishment of the PRC.
[11] https://worldpopulationreview.com/world-cities/shanghai-population (accessed 21st of February, 2023).
[12] Unregistered migrants and immigrants likely make these officially tallied figures higher.

Figure 5: Rural Lujiazui in Pudong before the development of what is now the Lujiazui Central Financial District. (Source: https://www.sohu.com/a/275885946_194255).

Figure 6: Shanghai's new (left side) and old (right side) financial centres facing each other across the Huangpu River, which is still a significant gateway for global trade and a major waterway to the Pacific Ocean. (Source: https://www.shutterstock.com/zh/imag)

Today, Shanghai is the most expensive city in China to live in. Property prices make buying a house for young people increasingly impossible and a cup of coffee averages at almost GBP 5 or more. SUVs and Ferraris share the same roads as simple motor-drawn trolleys piled high with sheets of cardboard (Fig. 7) collected to fetch a few RMB (人民币; Chinese currency). Cocktails costing GBP 10-12 are liberally consumed in the same city with those who skip meals as they find paying GBP 1.20 for a plate too expensive.[13] This continuum of inequality and diverse lifestyles is no doubt the case in many major cities in the world today. Nonetheless, it has implications for the proliferation and control of an infectious airborne disease such as tuberculosis.

Figure 7: Street sights (Photo: Diego Azubel/EPA; Illustration: Cena Lau)

[13] Conversion rate of RMB 1 = GBP 0.01175 on on March 31st, 2023.

Given this multifaceted fieldsite with a long social history, this chapter seeks to achieve two things: to set the historical and socio-political context of Shanghai, and to introduce its contemporary tuberculosis control programme and how it operates vis-à-vis the socio-political status of patients. The first section will provide an overview of the historical development of tuberculosis control efforts in the country and then, specifically, in Shanghai throughout the twentieth century to the present day.

The second section will introduce the contemporary Shanghai tuberculosis programme (STP) by following the experiences of a newly diagnosed patient as she finds herself at the edge of policy looking in. The ethnography draws out the socio-economic and political in the patient's personal circumstances that inform her decision-making. In doing so, we see how the social maps onto the epidemiological.

The final section further explores the social realities negotiated by those most susceptible to tuberculosis infection – migrant workers and the elderly – and the implications their lived experiences have on how public health policy plays out in this urban setting. This section focuses on the centrality of *hukou* and how it differentiates and determines access to the basics of life for individuals.

THE HISTORICAL DEVELOPMENT OF TUBERCULOSIS CONTROL IN CHINA AND SHANGHAI

Tuberculosis control is carried out in context, with its enactment and effects fundamentally entangled with the social, economic and political conditions extant at any given time. This section provides some of this background to situate the lived context in which Chinese and, specifically, Shanghainese efforts to manage its epidemic were carried out during the twentieth century and into the present day. It traces the historical development of Shanghai's public health and tuberculosis control programme and demonstrates how profoundly linked medicine and infectious disease are to the social, economic and political, whilst always being inextricably embedded within the local and geopolitical. Indeed, this observation is mirrored in the structure of this thesis, which begins with examining how global influences affect the local, even the local microbiological (Koch 2011), and develops to demonstrate how the local comes to shape the global.

I begin this historical account during the period of Republican China (1912-1949) as it was then that tuberculosis began to receive dedicated attention as a public health issue. Historian of medicine and science Mary Augusta Brazelton has shown

how the Nationalist government laid the foundations that facilitated the later progress made by the Communists in the area of public health and tuberculosis control (2019a). Moreover, she has demonstrated the engaged and significant role played by the Nationalist government in founding the project of 'global health' and its related institutions, including the World Health Organisation (2019b, 2022).[14] However, plagued by both an international war and civil conflict, the dispersed and decentralised Nationalist government indeed achieved only limited success in the improvement of public health prior to the Communists taking power and the formation of the People's Republic of China in 1949. The communist government implemented multiple public health methods and campaigns that became internationally renowned for lowering mortality and disease incidence whilst raising access to treatment and promoting recovery. Later, the country's embrace of capitalism brought new challenges during the Reform period, which spurred the implementation of the CDC model of public health and the more widespread incorporation of DOTS as the primary method of tuberculosis control nationally. Through this history, we see how similar the present-day organisation of tuberculosis control has remained to the Maoist system despite the incorporation of the US-based CDC model.

Prior to 1949: The Challenges of Wartime and Dividedness

Imperial China ended in 1911, when a succession of revolutionary uprisings overthrew the Qing dynasty. Sun Yat-sen's Nationalist Party (国民党; *Guomindang*) played a prominent role in ushering in the new Republic of China in 1912, but only in 1928, after years of armed and political struggle, did the Guomindang succeed in imposing itself as the national government. The new administration sought to unite and modernise a fragmented China into an independent and sovereign nation by ridding itself of the European imperial powers that had exploited its internal divisions for their own gain for a century (K.-C. Yip 1995). In attempting this feat, the Nationalists had to contend with reforming a country that had "a huge population, massive poverty, a high illiteracy rate, a high incidence of disease and widespread epidemics, rural discontent and social inequality, and a poor transportation system" (Ibid. 3). However, the administration remained divided throughout this time and the country was still fragmented and governed by various coalitions headed by military warlords. The situation was further compounded by the Japanese occupation of China and the Second Sino-Japanese War (1937-45). The Nationalists and the Communists joined forces to defeat the Japanese and continued to fight out their ideological differences

[14] Siming Si (or Szeming Sze; 1908-1998)) was the general secretary of the China Medical Association and, later, a co-founder of the WHO (Lei 2010).

immediately afterwards through the Chinese Civil War (1945-49). The civil fighting finally culminated in the Communist victory over the Nationalist government, whose leaders fled to Taiwan, and the establishment of the People's Republic of China in 1949.

Before losing the war, the Nationalist government had attempted to implement the Nationalist Health Reconstruction Programme, a part of which was the nation's first attempt at collecting and compiling vital health statistics for the entire country. In terms of public health programmes, they focused on the category of notifiable infectious diseases (法定传染病; *fading chuanranbing*) such as plague and smallpox that caused "swift-moving, devastating epidemics" (Brazelton 2019a, 36). Tuberculosis was notably not included in this category, being regarded as, in contrast, a slow-moving social disease caused by the conditions of impoverishment that resulted from poverty and the side effects of urban and industrial development. The conflict-ridden Republic was unable either to organise nor finance the social, economic and infrastructural changes necessary to address these issues.

Nonetheless, tuberculosis was a major public health problem during this time, estimated to have caused some 60 to 140 deaths per 100,000 annually from 1926 to the onset of the Second Sino-Japanese War (Core 2014, 134). The dearth of state action against this significant epidemic compelled Yan Fuqing (颜福庆) and Wu Liande (伍连德), along with other Western-trained health professionals, to establish the Chinese Anti-tuberculosis Association (CATA) or the *Zhongguo fanglao xiehui* (中国防涝协会) in 1933 (33). It was the first and only organisation dedicated to the control of a single disease and was set up to address both prevention and treatment. It had to suspend its services in 1937, however, due to the ravages of the Second Sino-Japanese war. In Shanghai, the Shanghai Anti-tuberculosis Association (SATA) or *Shanghai fanglao xiehui* (上海防痨协会) was established in 1938 to fill the void left by the suspension of CATA (Core 2014).

The Japanese occupation worsened conditions in Shanghai and hundreds of thousands were made homeless refugees by the violence and bombing. These victims of war then subsisted in crowded and unsanitary environments that fostered the spread of disease, including tuberculosis. It was calculated that tuberculosis was China's deadliest disease at this time with the affliction killing 1.2 million people each year (Lei 2010). SATA was established in response to this intense need. Anti-

tuberculosis antibiotics had not yet been discovered and the primary treatment method was bedrest supplemented by nutritious food and fresh air. However, SATA was not a governmental organisation, with its committee comprised of both foreign and local members, and it constantly struggled with financial issues and difficulties in providing the clinical and nutritional care its patients required.

In 1939, the Nationalist government offered SATA the use of a hospital in the district of Xuhui (Core 2019). However, this opportunity was unsustainable as the rent was raised 100% in the first year and by 400% by the time SATA was forced to vacate the property 3 years later. One hundred beds were dedicated to charity tuberculosis patients and financed by "companies, nonprofit organisations, and individuals, including the Shanghai International Red Cross and a New York-based NGO called China Child Welfare" (Core 2014, 131). Bed sponsorship raised the number of tuberculosis beds to 230, but this increase was still insufficient to cater for the number of patients in need and the turnover of beds was slow. Moreover, the hospital beds were on loan from the government, which decided to reclaim them in 1941. Patients were left to recover on the ground as a result. A newspaper article was successful in disseminating widespread awareness of this dire state of affairs and one hundred beds were donated by Shanghailanders,[15] which helped to ease the emergency. The organisation struggled with salary issues for its medical staff who felt they deserved more compensation for the long hours and high risks they took caring for tuberculosis patients who were generally in quite advanced stages of their illness by the time they reached the hospital for treatment. An increase of 20% was finally authorised but this amount remained inadequate against the rampant wartime inflation. Inflation and scarcity further made the provision of adequate nutrition to patients difficult, which greatly affected and prolonged recovery rates.

These financial pressures resulted in the SATA finally cutting ties with the Xuhui hospital in 1942. It set up a Hospital Building and Equipment Fund Campaign that raised more than a million dollars that enabled the purchase of the Municipal Council Sanitorium in 1942, which became the new site of the SATA Tuberculosis Hospital (Core 2014). The organisation continued its work in trying to secure beds and, as per global practices, started to engage in active case finding (ACF) methods following a donation of x-ray equipment after the Pacific War (1941-45) (Core 2019). This entailed medical personnel going into the city in vehicles with chest x-ray machines to screen people for tuberculosis. This was a major change from waiting for

[15] Foreigners who came to live in Shanghai during the colonial period and whose fortunes were linked to the foreign concessions and extraterritorial privileges in China.

patients to search out treatment from the organisation (i.e., passive case finding; PCF), at which stage their infection would most likely be at an advanced stage and recovery unlikely.

The costs of wartime Shanghai continued to make the provision of adequate care extremely difficult but the efforts of the CATA (resumed in 1945) and SATA had drawn attention to the urgency of the epidemic. It was during this time that a doctor called Wu Shaoqing (吴绍青) started to teach at Shanghai Medical College (SMC) and work as Director of Pulmonary Medicine in Zhongshan Hospital. With his influence, he brought together twelve medical and civic institutions, including the SATA, to join and collaborate in properly tackling the endemic disease (Core 2014). The new communist government supported this clarion call and installed the necessary infrastructure to promote its execution.

Post-1949: Control Through Infrastructure

In the People's Republic of China, the communist government reframed tuberculosis as "a disease of capitalist exploitation created by poor living and working conditions that made workers susceptible" (Core 2019, 83). In contrast to the Republican Period, control of the disease and epidemic took priority in the Maoist period as it went against the political order of the day. A three-tiered health system was created and installed that was tied to a system of employment and welfare in the urban centres that afforded citizens unprecedented access to healthcare. The socialisation of state institutions and non-profits like hospitals and the SATA reconfigured work places into the work-unit or *danwei* (单位) system. This organised workers into units based on their occupation and provided them with an 'iron rice bowl' that guaranteed the necessities of life including food, housing, education for children, employment, a pension, healthcare and more. The housing spaces were oftentimes crowded and food was not always plentiful but living conditions within *danwei* were far better than those during wartime, which were still a fresh memory (Core 2016). It should be noted that individuals needed to have a local household registration *hukou* (户口; further discussed later in this chapter) in order to enter into a *danwei* and were tied to their place of *hukou*, be it rural or urban. There was little chance of moving to other parts of the country or, indeed, even within the same province during this time, and certainly not from a rural to urban resident status.

The benefits of this health infrastructure were demonstrated through the decrease in disease incidence even before the introduction of antibiotics in China.

Historian of medicine Rachel Core writes that this was due to multiple factors, including the mass promotion and vaccination of infants with the Bacillus Calmette-Guérin (BCG) vaccine as well as the unprecedented stability brought by the *danwei* system (Core 2014).[16] The new system linked the population with steady employment, food supply, and access to public healthcare. The arrival of antibiotics brought further improvement to treatment and recovery rates. Shanghai's population had grown to 5 million by the onset of the PRC in 1950. Deaths from tuberculosis infection were estimated at 208 per 100,000 in 1951 and reduced to 25 per 100,000 by 1973 (133-134). Moreover, CATA and SATA began to receive government funding, which greatly stabilised their work and services.

Consistent funding further enabled SATA medical staff to specialise in tuberculosis control. In the new People's Republic, these professionals came to man a three-tiered health system, which is largely the same structure in place now. The system was divided into the municipal, district and workplace levels. The municipal level included designated chest hospitals for treating tuberculosis and managing patient treatment. It also held training courses for personnel and set policy for the district and workplace levels to follow. District-level anti-epidemic stations (防疫站; *fangyi zhan;*) were set up in 1953-1958 and functioned as vital nodes for ensuring patient management and the implementation of policy. Staff from this level attended training in prevention, diagnosis and treatment held by the municipal institutions and also went to the workplace settings to aid personnel there enact policy. Similarly, those at the level of the workplace cooperated with district staff to implement policy as well as care for the health of *danwei* employees. A major part of the work at this stage was the recording and compiling of health statistics from ACF screenings carried out in factories and schools. The SATA held frequent health education sessions in *danwei* and published didactic public health materials.

This era further saw the cultivation of a close working relationship between the district and workplace levels. This relationship included the hierarchical evaluation of work performance and allocation of rewards or punishments. Writing in terms of a factory context, sociologist Andrew G. Walder describes the use of 'work group incentive practices', which were practically ubiquitous by 1957, as being "not only a structural innovation, but also an attempt to develop a more effective means of motivating workers" (Walder 1988, 111). These incentive practices replaced the Soviet

[16] Interestingly, the first efforts to promote the BCG was carried out during with the support of the Nationalist government. Without this ground work, the mass uptake of BCG vaccination may not have been as high during the early PRC (Brazelton 2019a).

use of the piece rates system, which compensated each task completed, or 'piece' made in a factory setting.[17] *Danwei* set aside a portion of planned and unplanned profits to comprise a bonus fund. Percentages of this fund were distributed monthly and annually to incentivise workers who reached targets, with extra funding for those who surpassed set quotas. Workers within *danwei* who did not meet quotas were penalised and did not receive bonuses. Monthly and yearly targets were set by the *danwei* and divided evenly amongst all workers. Evaluations were carried out by a group leader who assessed workers' work *biaoxian* (表现; affective performance) as well as *biaoyan* (表演; performance) (see Chapter Five for more on contemporary work performance evaluation).

Since 1979, a 'reformed' type of work group incentive practice has been favoured that evaluates work performance in terms of attendance and tasks carried out, measured statistically through a points system if possible. There is no allocation of points for political thought in contrast to previous varieties of incentive practices.[18] In the chapters that follow, we will see that this is largely the same structure of workplace management in place today, with those higher in the hierarchy evaluating those placed lower. I will demonstrate how this points system and the essential need to make these metrics not only structure but profoundly compel how tuberculosis control is carried out as well as health professionals' experiences of engaging in this labour. Moreover, this fixation on metrics (Muller 2018) necessitates the abstraction of patients and their lived realities into numbers. These numbers form the units and facilitate the cultivation of indicator culture (Merry 2016).

Rates of tuberculosis continued to decrease throughout the Maoist period and by 1979, incidence was measured at 10 per 100,000 (Core 2014, 134). However, the dismantling of the *danwei* system during the subsequent Reform Period has seen the resurgence of the disease (Core 2016). The social, economic and political changes brought by the Reform and Opening (改革开放; *gaige kaifang*) of China have posed new sets of healthcare challenges (W. Yip and Hsiao 2014) and spurred the incorporation of the CDC model into its official system of public health. Today, the three-tiered health system structure is still intact with CDC methods having been

[17] According to Walder, the piece rate system failed to persist in Maoist due to a "deep distrust of the efficacy and desirability of material incentives in the absence of an accompanying framework of political organization and control." (1988, 111)

[18] The 'original' type was most popular during 1978-1980s with all evaluations depending on the judgement of the group leader. The 'ascetic' type, devised during the Cultural Revolution and used from 1967-1977, rejected material pay and incentivised workers through "mechanisms of group evaluation, criticism, and intensified political study and indoctrination." (Ibid. 112).

adjusted to fit the Chinese health infrastructure, contrary to the opposite often having been described as being the case.

Present Day: The Reform Period, the CDC Model, and the creation of DOTS

The Reform Period saw the disintegration of the Maoist-style system of healthcare, with its breakdown becoming most apparent both nationally and internationally with the 2003 SARS outbreak. The government had made economic growth the priority and withdrawn financial support from many areas, including public health provision and development. Governmental provision of total health expenditure fell from 32% to 16% between 1978, and 2002 and saw hospitals and anti-epidemic stations having to generate their own revenue and function as for-profit institutions to survive (L. Wang, Liu, and Chin 2007). Some efforts had been made for systemic reform in the early 2000s to address China's changing epidemiological landscape: incommunicable diseases, such as cancer, stroke and diabetes, had replaced communicable diseases as the main cause of mortality, and longer life expectancy amongst the population had led to increased rates of chronic disease and their necessary management (Peng et al. 2003). However, the SARS event revealed the under-funded, over-strained and neglected public health system extant in China at the time (see e.g., K. Mason 2016a, 9-14; Y. Huang 2013, Ch. 4) and the CCP's initial refusal to recognise the extent of the outbreak was met with internal and international comment and critique.[19] This public embarrassment spurred much-needed governmental interest and investment in national health infrastructure and programmes that had previously operated opaquely and suffered from inertia (Table 3).

[19] It was military surgeon Jiang Yanyong's interview to Time Magazine that revealed the actual extent of the SARS outbreak in China in 2003 https://content.time.com/time/subscriber/article/0,33009,441615,00.html. This information immediately caused the WHO to travel to Beijing to investigate the claims of hidden SARS cases, putting pressure on the CCP to finally recognise the actual extent of the epidemic that they had downplayed in previous reporting.

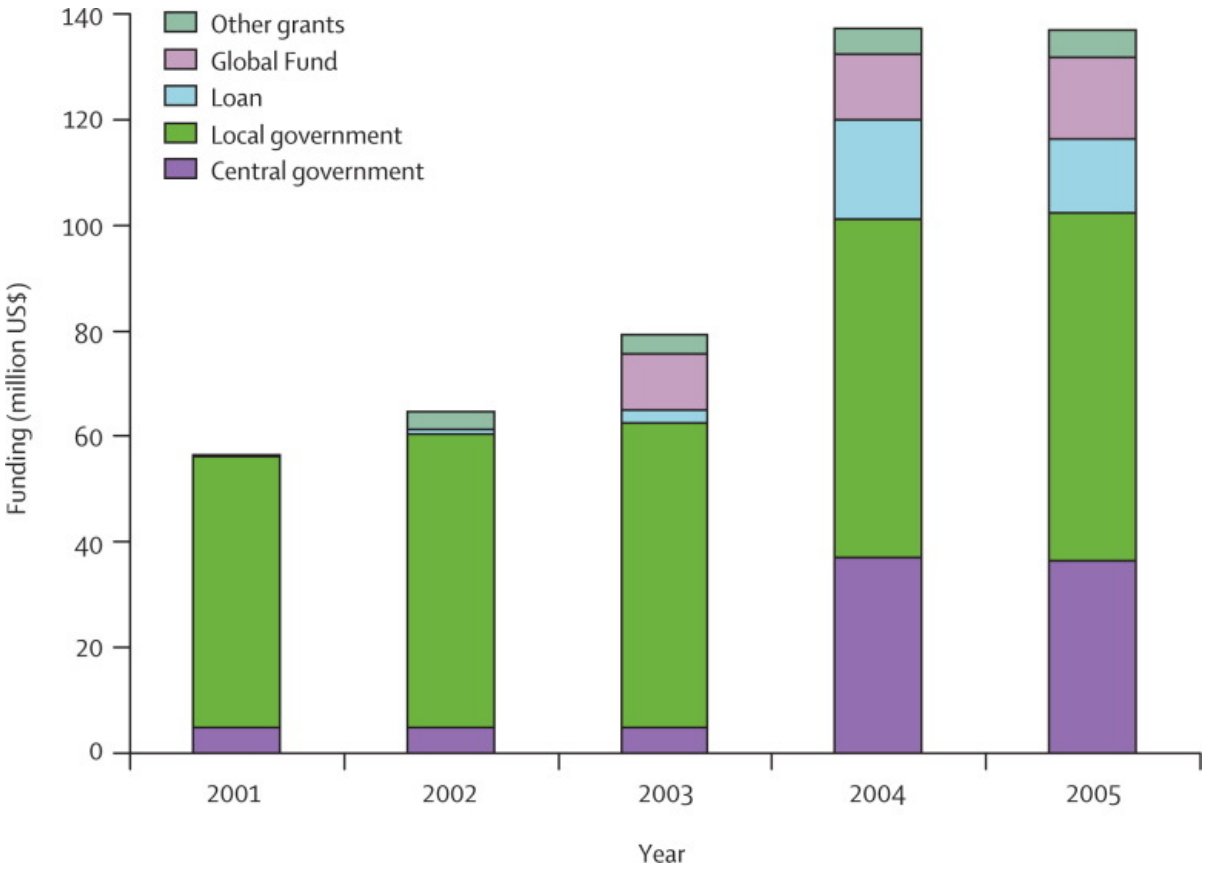

Table 3: Funding for Tuberculosis Control before and after the SARS epidemic.
(L. Wang, Liu, and Chin 2007, 693)

The dramatic change in approach represented the CCP's shift in focus from public hygiene *provision* to public health *management* that had already been underway since the beginning of the Reform Period. In post-Mao China, the locus of *responsibility* had come to rest upon the individual to seek out healthcare for themselves and comply with treatment rather than it being the state's duty to provide accessible healthcare for its population. The following will comment on this significant shift in national ideology and practice. It will then describe China's role as the pilot testbed for what became the global DOTS programme for the management of tuberculosis.

As above-mentioned, the anti-epidemic stations were installed nationwide in the 1950s and drew from a Soviet model of public hygiene that focused on sanitation and maintenance of the local environment. Doing so was politically motivated as Soviet hygienists sought to cleanse the population and society of the filth and dirt of the 'old' capitalist ways for a projected future that was to be dirt- and disease-free, having become clean and 'pure'. Becoming 'pure' in this sense meant that any element or person opposed to this vision would be cleansed so as not to pose risk or

potential harm to the Body Soviet comprised of individuals and their hygienic lifestyles and practices (Starks 2008). China had adopted this ideological approach as well as the view that "caring for the population was a *duty*" (Ibid., 3 emphasis mine) – that the provision of care was the state's duty as well the individual's duty – in order to strengthen society and, as result, the country as a whole. Moreover, it represented the continued development of hygienic modernity, a concept that had been imported by the Japanese into China during the first Sino-Japanese War (1894-95; Rogaski 2004),[20] but a version of it now infused with a strong socialist spirit.

The decentralisation of the healthcare system brought about by post-1979 reforms saw the at times gradual but certain withdrawal of the state from the provision of healthcare for its population as well as funding for its institutions, tasking them with the responsibility of caring for their own health and survival (e.g., X. Li et al. 2020; Tu 2018; W. Yip and Hsiao 2014; E. Zhang, Kleinman, and Tu 2011). The adoption of the US CDC model was a response to the national need for increased epidemic preparedness as spotlighted by the SARS episode (K. Mason 2016a) but also because it fit the ideology that the state is there to manage the public's health if the individual chooses to seek out such services. The responsibility or duty to uphold public hygiene for the good of society had transitioned to the individual's responsibility to choose whether or not to maintain their own health through complying with the state's management programmes. The US CDC model also emphasised the primacy of epidemiology and laboratory-based medicine in managing population health, aligning with China's focus on developing its scientific and technical expertise in order to take its place as a competitive presence on the international stage (e.g., Greenhalgh and Zhang 2020). Having considered various models, including those from Europe, Russia, Japan and Singapore (Peng et al. 2003), the US CDC model was selected and the Shanghai CDC (SCDC) was created in 1998. Its successes led to the establishment of the national CDC in Beijing in 2002 as well as CDCs in twenty-eight other provinces.

The current globally endorsed DOTS model was first piloted in China in the 1990s.[21] However, a locally designed programme for managing tuberculosis drug-

[20] The Japanese term for public health *eisei* was originally inspired by the Chinese term *weisheng* (卫生), which means 'guarding health'. It was translated back into *weisheng* when imported to China, however, the early twentieth-century Chinese interpretation of the term differed from the Japanese vision and as a result, so did its practices (Rogaski 2004).

[21] The rest of this historical account is largely drawn from the book *Achievements and Challenges in Tuberculosis Control in Modern China* by Lixia Wang, Paul Pomeroy Nunn and Shaofa Xu (2016), two of whom are the directors of the national and clinical centres of tuberculosis control and prevention in the Chinese CDC in Beijing.

treatment had already been underway since 1981. The Whole Course Treatment and Management (WCTM) programme (1981-1990) was designed specifically for pulmonary tuberculosis cases that entailed giving a set number of drugs to a patient and supervising their administration either in clinic or patients' home settings through counting the number of pills. These records were further kept using patient record cards (Lixia Wang, Nunn, and Xu 2016). This first tuberculosis plan was drawn up with a focus on prevention and control that notably incorporated international standards as well as the experience of local physicians to tackle the disease and its management. The state assumed responsibility for the programme and for the distribution of BCG vaccines to children. Moreover, the programme was linked with health institutions and organised staff trainings that fostered the professionalisation of personnel.

At the same time, government withdrawal from healthcare funding continued; from the early 1980s to 1993, the state's total health expenditure decreased from almost 40% to less than 20% (Hipgrave 2011, 229). The government provided less subsidies for medical costs and in the late twentieth century, China began to see instances of illness becoming the main reason for poverty. Moreover, health institutions and hospitals, including community hospitals, increasingly prioritised illnesses that charge for service fees, drugs, scans and laboratory tests. With its treatment being funded by the state, tuberculosis was not, and still is not, a lucrative illness to treat and has become increasingly neglected as a result – in hospitals, tuberculosis departments and doctors bring in less money as they cannot charge for drugs and basic tests due to 'free treatment' policy.[22] A national survey conducted in 1990 showed that for all the efforts made by the first tuberculosis plan programme, rates of tuberculosis continued to increase due to the increase in population and the fragmentation and decentralisation of the healthcare system (Lixia Wang, Nunn, and Xu 2016). The changing policies have made accessing treatment challenging and adhering to long treatment regimens difficult for those most susceptible to the disease – that is, the socio-economically less well-off. These findings spurred the decision that the country needed to expand the programme to reach those on the periphery and that it would need financial support to do so.

China applied to the World Bank (WB) for this funding and was granted monies to finance health care delivery for the first time.[23] The WB agreed to the request on

[22] 'Free treatment' is not completely free, however, as discussed further in Chapter Four. See also Dirlikov (2020) for an example in Yunnan province.
[23] Four previous WB loans had provided support for installing infrastructure only.

the condition that the DOTS methods of Karel Styblo[24] and WHO policies would comprise the core of the efforts. The details of how the project would be applied were then to be hashed out in conversations between Chinese and foreign experts. It was through encountering each other on issues such as treatment ethics and moral values that the practicalities of finite funding were debated and a consensus found. These issues included whether or not, for the first time, to distribute drugs in combination packs as opposed to individual blister packs; whether to incentivise health workers to diagnose new cases; should smear-negative patients be entitled to free treatment or not due to funding limitations and, if so, how to maintain free treatment for patients – where would the additional money come from?

The nine-year project, the Infectious and Endemic Disease Control (IEDC) Project or 'The Project' for short, as it was known in China, commenced in 1991. The testing of these principles both fixed and experimental became the foundation for a standardised and globalised DOTS. Its successes in lowering national tuberculosis prevalence and attaining high cure rates (Chen et al. 2002) heralded The Project as proof that the large-scale and rapid expansion of DOTS was feasible and promoted its adoption globally. It should be noted that municipalities like Beijing and Shanghai were not included in the IEDC Project. Subsequent collaborations with the Global Fund (2004-2014) and the Bill and Melinda Gates Foundation (China-Gates TB Project 2009-2019) have further supported the continuation and expansion of DOTS in China, now with a particular focus on DR-TB. The DOTS programme in China is now largely domestically funded by the government.

ENTERING THE SYSTEM: DOTS IN SHANGHAI TODAY

In the main hall, Liu Wen (刘文) manages to pay the registration fee and makes her way through the frenetic crowd of expectant patients towards the doctors' examination rooms. The waiting area here is a little less crowded. Luckily, the seat next to where Liu Wen is standing becomes free after a few minutes and she is able to finally sit down and rest. Her whole body feels heavy and tired after making the journey to this local hospital to see a doctor, and from fighting the battle that was Registration (挂号; *guahao*). She coughs again. She reaches out her hand to steady herself against the wall until the fit passes. This cough has been plaguing her for

[24] Dr. Karel Styblo was the director of the International Union Against Tuberculosis and Lung Disease in 1979 and is famous for developing the DOTS approach.

weeks. Recently, she's been coughing more frequently and now feels a pain in her chest when she does. She's also been having headaches and feeling feverish, sweating a lot particularly at night. Her friends keep remarking that her face-colour (脸色; *lianse*) looks pale, and it's true that she hasn't had much of an appetite lately. Mostly though, the lady she cleans for has been scrutinising her suspiciously for the past week and yesterday asked her if she was sick. Liu Wen has already tried to number of traditional Chinese medicines (中成药; *zhongchengyao*) as well as western medicines (西药; *xiyao*) but the cough, fever and fatigue have not gone away. She's uneasy that her employer, Ms. Wang (王), might complain about her to the head of her workplace, Fang Laoshi (方老师; Teacher Fang).

Fang Laoshi is a pedantic woman; head of the domestic helper recruitment agency (保姆公司; *baomugongsi*) and always checking up on them. She calls the head *laoshi* even though she is the same age as Liu Wen. So far, Liu Wen has successfully avoided Laoshi as so many of them share and sleep in the *gongsi* space that she can get by without having to interact with her too much. There's always people there: sleeping between shifts on shared beds, showering, cooking, playing cards, gossiping or arguing. She lives in this space with all the others because rent in Shanghai is so expensive and she prefers to send the money she earns back home. This year, Liu Wen's son started a master's course in Tourism and Management, and also got engaged. That means that two years of high university fees, bridewealth of tens of thousands of RMB, and a house (the mother-in-law-to-be insisted on this) are all due. Liu Wen can't afford not to work. Best to go to the doctor and get better once and for all before Ms. Wang or Laoshi ask any more questions, she's decided. Hence her recuperating on this hard-plastic seat this morning. The queue isn't that long and Liu Wen estimates that she should be in time for her afternoon session in Ms. Wang apartment. "Liu Wen", calls out the nurse. Liu Wen gets up slowly and enters examination room number five.

"What's the problem?" Dr. Li (李) asks from behind her facemask. Her eyes don't leave the computer screen as she stretches out her hand for the logbook and patient card.

"Hello Doctor, I haven't been feeling well", the patient begins, but starts to cough so severely that she is unable to finish. Dr. Li's eyes dart to look at the patient,

and then move back to the screen. She finally stops coughing and hands over her book and card. Dr. Li swipes the card and reads the name: 'Liu Wen'. The patient sits down slowly and starts to narrate her symptoms; when they started; how they've progressed; what medicines she's taken; how she feels. Dr. Li listens, and again peers sideways at the patient on her right-hand side without moving her head or body, which are both turned left to face the computer. The patient is pale with some beads of sweat on her forehead and on top of her upper lip. Her cheekbones protrude sharply and her back is curved with the effort of sitting upright in the chair.

"You might have tuberculosis (结核病; *jiehebing*)", states Dr. Li, whose eyes have once again returned to the screen. "But I can't diagnose that here, you have to go to a designated hospital (定点医院; *dingdian yiyuan*). Here's a list of all the designated hospitals in Shanghai," handing Liu Wen a piece of paper with hospital addresses. "In the meantime, you have to get bloods checked and take these medicines." Having inputted the requests for tests and prescription, Dr. Li feeds the logbook through the specialist printer that duplicates all she just typed on the computer. "Pay at the cashier. Give one of the receipts when picking up your medicines at the pharmacy and then show the other to the nurse in the bloods area and she'll take your blood. Bring me back the results. Quickly", orders Dr. Li handing back the patient card and logbook, now with today's consultation and outcome recorded. She is anxious to see to the next patient who has already entered the office – the waiting room seems to be particularly thronged this morning. "What's the problem?" asks Dr. Li, already with her hand outstretched towards the new patient standing in front of and blocking the previous patient. Three more impatient individuals take up the doorway waiting to get in.

"You might have *jiehebing* (结核病)." Liu Wen is confused. How can she have tuberculosis? What is a designated hospital? Why can't this doctor diagnose her? What medicines is she being prescribed and for what, for the tuberculosis? There's no time to ask as the next patient has already pushed their way through the doorway and is standing between her and the doctor with three others occupying the entrance, their faces concentrated on getting to the desk with the white-coated doctor. It feels like they're poised and ready to burst through the door at the first signal lest anyone should skip them – everyone here is anxious about their health. Liu Wen gets up slowly from the chair and braces herself to do battle through the doorway. She gets through the push and looks down at the piece of paper she's been given. She scans

the addresses but none of them are familiar; she'll have to ask someone back at the *gongsi*. This means that she'll have to take more time to go to this designated hospital, wherever it is. Liu Wen feels frustrated and nervous. She's heard of other people in her home town (老家; *laojia*) having tuberculosis and it was quite serious. She's not sure what the symptoms are but even the name *jiehebing* makes her uneasy; she can't let Ms. Wang or Laoshi know.

Liu Wen makes her way to the cashier's desk, the same site as where the battle of Registration took place earlier. The cashier swipes her patient card and Liu Wen is shocked to hear the balance owed. It would never be this expensive in her hometown in Hubei. As her household registration or *hukou* (户口) is from Hubei, she has no social welfare rights here in Shanghai, including no subsidised public health insurance. Liu Wen pays the total reluctantly, uneasy about spending so much money on herself, and on drugs and tests that she's not sure she needs. The cashier works at lightning speed, never looking up at the individual they are serving. Liu Wen takes back her card and the receipts and makes her way to the pharmacy window. There, she again has to elbow her way to the counter and, holding her card, sticks her hand in through the counter window towards the pharmacist who, it feels like, only attends to cards and paper but not people. The pharmacist takes her card and swipes it. He reads the computer screen and soon collates five boxes, extending his hand to Liu Wen for the receipts. Liu Wen is not sure which one and hands all the receipts over to him. He selects one, checks the receipts against the boxes, crosses off the corresponding drug names, and pushes the boxes across the counter. Liu Wen takes them, unsure as to what they are for and how to take them – perhaps it will be written on the logbook – and tries to figure out where the bloods station is. She suddenly coughs explosively, and her chest flares up in pain. Again, she reaches to the wall to steady herself, waiting for the pain to subside. Best to get these bloods done, she reaffirms to herself. She slowly approaches the information desk and gets directions to the bloods station. This time she doesn't have to do battle and is able to hand over her card, her receipt, and her arm for blood to be taken quite smoothly.

"Collect the results at the cashier in twenty minutes", shouts a nurse from behind a facemask and through the windowpane. Liu Wen looks at her watch. It's already approaching 9.30 am. She is supposed to be at Ms. Wang's house for 10.30 am, which is 40 minutes from the community health centre. All of this is making her light-headed and she needs to sit down. She'll wait for the results, she decides, as she knows she won't come back for them otherwise. She can feel the cold sweat on her forehead and all over her back and she feels weak. Twenty minutes later, she checks

to see if the results have arrived. Yes, they have. Liu Wen collects the printout and makes her way back to the doctor's office, pushing her way in the door as she'd seen the others do earlier. She is told her white blood cell count is high and, again, that she needs to go to the designated hospital. Before she can ask the doctor what the results mean another person has pushed past. Liu Wen battles through the doorway and tries to walk briskly to the bus stop. She arrived at the hospital at 7.30 am that morning and now she's late for work. She's relieved when the bus arrives quickly and there's even a seat at the front. Just as she sits she coughs explosively again. Gripping the handrail, she waits for the pain to subside. Liu Wen catches her breath, and hopes that Ms. Wang will be out this morning.

Liu Wen cautiously stepped through the entrance. The hallway is dimly lit and there are no signs. She's been directed to this building, located separately from the rest of the hospital, to a doorway at the bottom of a staircase. Now inside, she looks left into deeper darkness, and then right to see a nurse sitting behind a windowpane with a sign saying 'Registration' above her. That must be it. Liu Wen makes her way to the counter and is registered to see the doctor. There were two patients ahead of her, one elderly man with his daughter, and the other a boy in his teens on his own. They are seen to quickly and Liu Wen's name is soon called. Another coughing fit takes hold of her as she goes to stand up and Liu Wen falls back into the seat. It's been three weeks since she went to the community hospital and the cough has become more severe and the pain in her chest more intense. She has taken all the medications but they've made no difference. So she's finally taken another morning off to find this 'designated hospital' – she needs to get better. Her name is called a second time and she tries again to get up, walking slowly towards the doctor's office.

The next patient makes her way to into the office and to the desk. Dr. Zhang (张) looks up from the computer and watches her come in. "How are you feeling?", asks the doctor. I look at the patient and notice how pale she is, the beads of sweat on her forehead and above her lip. Her eyes look tired. She sits slowly into the chair and begins to recount her symptoms, their duration, and how they have progressed. Dr. Zhang asks for her x-ray print-out, clips it onto the illuminator and glances at it briefly.

"You need to get a chest CT", she informs the patient whilst typing the request into the system. "Come back and show me the printout when it's ready".

“What illness do I have?”, asks the patient, with concern in her voice and worry in her eyes.

“It’s possible you have tuberculosis but we need a clearer picture of your lungs to be more certain. Hurry, and come back here with the CT”.

As the patient left the office, Dr. Zhang turned to me and to explain what I just witnessed.

> That patient most likely has pulmonary tuberculosis [肺结核病; *feijiehebing*] and it’s protocol to confirm with chest CT and a sputum smear test. She’s coughing, pale, sweating, thin, very tired. She’s likely contagious at present and therefore potentially infecting others she comes in contact with within closed spaces. According to her *hukou*, she’s not from Shanghai. If she’s working as a domestic cleaner [保姆; *baomu*], which very often people from the countryside do, she may be living in the agency’s communal living area, which can be crowded, not well ventilated, and without much sunlight. Tuberculosis infection is more likely within those kinds of conditions. She may not be living like that, but even if so, she could be infecting others if she coughs in a confined space like a public bus or metro. So it’s very important that she takes the antibiotics and continues to take them if she does have tuberculosis. In most cases, the bacteria become non-infectious after two weeks of treatment, but if you are not consistent in taking the medicines or completely stop, which patients do when they start to feel better, then the infection can return or it can return in a mutated drug-resistant form. That’s why the community health doctors monitor patients to ensure that they do complete the treatment and don’t stop taking the drugs beforehand. It’s because the consequences are severe. Without fully completing their treatment, patients would continue to spread tuberculosis, and potentially DR-TB to others. DR-TB infections require two years or more of treatment and only just over half of patients recover. Previously, a patient’s poor adherence to their treatment regimens acquired DR-TB and usually in those patients who had a recurrent infection. In the last few years, I’ve seen more and more first-time infections of DR-TB, which means that patients are not taking their medications consistently and infecting others with virulent, harder-to-treat and, in some cases, impossible-to-treat strains of TB from the onset. This is now the most pressing issue for tuberculosis control globally.

As explained by Dr. Zhang, it is imperative that the full course of antibiotic drugs be taken in all cases of infection. In the case of tuberculosis, this course can entail numerous drugs multiple times a day for at least eight months to two years with uncomfortable and, in some instances, severe side effects. These conditions, as well as other factors such as socio-economic situation (e.g., Draus 2004), can often lead to the patient not completing or being unable to complete their treatment. This is an issue for both infection and drug resistance, and the resultant continued proliferation of this infectious disease. Incomplete or inconsistent adherence to antibiotic treatment for tuberculosis spurred the development of the WHO-endorsed policy of Directly Observed Therapy, Short Course (DOTS). This method of treatment management does as its name suggests: patients are required to be directly observed by a health worker in clinic when taking their medications, even checking under the patient's tongue to ensure the pills have been swallowed, for the entire treatment duration. The WHO declared tuberculosis a "global health emergency" in 1993 (Glaziou et al. 2011) and has urged the uptake of DOTS worldwide as the standard method for controlling tuberculosis since then.

Directly observing each and every patient in a country with the world's largest population and second-largest tuberculosis burden has been described by my interlocutors as 'impossible'. Factors like a shortage of health professionals and logistical issues like access, for patients in either a massive sprawling city or remote rural area, make such a demand untenable. In Shanghai, direct daily observation of patients taking their medications in clinic was deemed unfeasible in a city of over 6,000 km^2 with a population of more than 24 million and family observation was adopted instead.[25] Health professionals train willing family members to monitor the patient's regimen and collaborate with them to manage treatment progress from afar. They may also pay house visits and communicate with the patient and family members through phone calls, web texts and voicenotes.

Shanghai has an integrated TB control network that spans its seventeen districts (Fig. 8) composed of the municipal Shanghai Center for Disease Control and Prevention (SCDC), district CDCs, designated hospitals, general hospitals, and community health centres (CHCs). The features of the three-tiered health system crafted over the twentieth century are observable and now bolstered by internet

[25] In 2014, the year-end resident population in Shanghai was 24.26 million, as reported by the Shanghai Municipal Bureau of Statistics (https://tjj.sh.gov.cn/tjnj/nje15.htm?d1=2015tjnje/E0201.htm). I give this figure as it is when the fieldwork took place. The Bureau also reports year-end registered population of 14.49 million. This indicates the possibility of 9.77 million unregistered residents in that year.

technology.[26] Real-time reporting and communication enabled by the Tuberculosis Information Management System (TBIMS) now traverses the physical space of the metropolis both vertically and horizontally. This online and protected platform was first introduced in 2005 to replace paper report card recording of tuberculosis incidence and treatment management, and links in with the wider national Infectious Disease Reporting System that deals with information regarding the country's thirty-seven other notifiable diseases (Huang et al. 2014). Amongst other functions, the CDCs, and in particular the municipal SCDC, are responsible for the surveillance, recording and collating of this epidemiological data for informing public health policy at the municipal and national levels.

[26] In 2014, at the time of this research, Shanghai was composed of seventeen districts. The official number is now sixteen districts after Jingan and Zhabei districts merged in 2015. Figure 5 of Shanghai and its districts thus refers to the pre-2015 organisation of the city.

Figure 8: District map of Shanghai in 2014. Shanghai's location on the east coast of China. (Source: https://www.shutterstock.com/zh/image-vector/shanghai-map-china-state-district-detailed-2205498967))

In terms of case management, if an individual attends a general hospital or a community health centre and is suspected to have tuberculosis following initial chest radiography (x-ray) or computed tomography (CT) scan, they are referred to a designated hospital. Within the STP, only designated hospitals can confirm a diagnosis of tuberculosis. Once diagnosed with tuberculosis via sputum smear, the patient is either admitted for clinical treatment as an inpatient if the infection is severe, or they can be prescribed standard tuberculosis treatment in the form of oral antibiotics and permitted to return home if the infection is less advanced. At the initial point of diagnosis, the attending doctor registers the details of the patient and the nurses must input the incident into the TBIMS within twenty-four hours. This information is then instantly distributed to the municipal, district and community levels. Multiple things then happen at this point.

Three sputum samples are collected from all patients. One sample will be tested by the designated hospital to confirm diagnosis, as mentioned above. If it tests smear positive, then two of the three samples will be sent to the municipal SCDC laboratory to undergo drug-sensitivity testing (DST) to assess for drug resistance. DST takes at least a month to culture under perfect conditions and longer in the case of contamination (see Chapter Two for more discussion).[27] The municipal laboratories carry out DST for all tuberculosis patients in Shanghai. The results are then entered into the patient's file within the TBIMS. All relevant health professionals can access the patient's information, including the clinicians in the designated hospitals, and the patient's drug regimen is adjusted accordingly.

Treatment as an inpatient may take one to two months of intensive therapy within a designated hospital. Otherwise, the newly diagnosed patient returns to the community and is asked to generally remain indoors and away from family members as much as possible and certainly for the first two weeks of treatment.[28] The patient then spends the duration of their treatment within the community whilst being monitored and managed by the district CDC, their community doctor, and a family member or by self-monitoring if none is available.

Upon re-entering the community, every patient will be contacted by the community doctor. Community doctors are required to check the TBIMS every

[27] In cases of contamination, the sample will have to be completely re-cultured again.

[28] This is because it has been widely assumed that patient's infections are no longer contagious after two weeks of treatment. More recent research has shown this to not always be the case: infections can remain contagious even after two weeks of antibiotics (e.g., Ko et al. 2017), and that patients with smear-negative tuberculosis can and do transmit the disease to others (Tostmann et al. 2008) although at a lower rate than previously found (Asadi et al. 2022).

morning for notification of newly diagnosed patients in their area and they are the only health professional at the community level to have access to patients' clinical information. They contact the patient using the details collected and registered by the designated hospital to arrange a home visit. This gives the patient an opportunity to meet their community doctor, for them to converse about treatment and reimbursement (further discussed in Chapter Four),[29] and for the doctor to identify and train a family member for home observation. If the patient gives an incorrect address or phone number at the point of diagnosis in the designated hospital, it can become almost impossible to find the patient again. If all runs according to protocol, however, the patient will complete their treatment in collaboration with their community doctor and appointed supervising family member, visiting the designated hospital every month for their prescription, and will undergo chest x-ray and sputum testing at the second, fifth- and sixth-month marks. The designated hospital continues to update the patient's file via the TBIMS upon every visit and the community doctor is kept appraised of the patient's progress via the online platform, which also informs them if a patient fails to make a hospital visit.

If this happens, it is then the responsibility of the community doctor to contact the patient to find out why they missed a visit and to ensure that the patient continues treatment. Failure to do so results in points being deducted from the doctor and, thus, the performance rating of the department, which can lead to a decrease in pay for staff across the whole department. Community doctors are responsible for ensuring that all of their patients fulfil treatment completion. This constitutes at least a 90%t success rate. Patients who do not attain completion will be recorded as an incident of failed patient-monitoring at the biannual performance evaluations (see Chapter Five for more on evaluations). Community doctors are also required to produce documentation demonstrating their year's activities and achievements for these evaluations. These are examined by personnel from the municipal SCDC and contribute to assessments of overall performance. Finally, the community doctor is responsible for managing the reimbursement paperwork for each patient. This involves filing and checking every receipt and script for reimbursable medical costs over the treatment period.[30] Reimbursement is officially only calculated at the point of 'cure' to discourage patients from defaulting on their treatment. However, monthly

[29] In the STP, patients are required to first pay for their tests and medications, and are then reimbursed for the costs after the completion of treatment, i.e., when they are determined 'cured'. Outside of Shanghai, tests and medications are provided free of charge to patients. In both contexts, only specific tests and drugs can be reimbursed or provided free of charge although others may be prescribed.

[30] Although tuberculosis treatment is described as 'free', there are many costs that are not covered by the STP, such as additional scan costs and liver protection medications, the latter being necessary due to side-effects from the antibiotic drugs (see Chapter Four for more discussion).

reimbursement can be arranged for exceptional cases and for DR-TB patients due to the extended length of their treatment.

In terms of access to information, only the community doctor working in a patient's registered community will be notified of their status as a new patient; only the district CDC responsible for the district in which this community is located will receive notice of this new patient; and the SCDC is notified of all incidences of 'new patient' across the city. District CDCs can view patient information from the clinical and community levels within their district only and are notified if a patient is not adhering to their treatment regimen, i.e., they don't make hospital visits in a timely manner; if they are identified as not taking their medications reliably; and if they have not had regular contact with their community doctor. If the situation persists, the district CDC will contact the community doctor (or the community doctor gets in contact first) to enquire as to why. The district CDC and the community doctor may negotiate how to manage a non-compliant patient, as well as whether or not non-adherence in this case will result in points lost. Both the district CDC and the community health doctor have a vested interest in not losing points.

All departments – community, district and municipal – undergo biannual evaluations and receive or lose points based on their performance throughout the year. All departments must produce material artefacts evidencing their work, i.e., physical books collating numbers achieved and/or not achieved; the forms filled; the presentations given, and so on.[31] Not only is there friendly rivalry between the different districts, but the total annual points dictate how much funding each district receives for the following year. Within this hierarchical and highly connected system, the municipal and district personnel evaluate community doctors in CHCs, municipal staff assess their district colleagues, and the SCDC department is evaluated by visiting counterparts from the national CDC in Beijing. The performance of district CDCs and CHCs throughout the entire municipality make up the SCDC's evaluation. Again, these points dictate how much financial support the SCDC will receive from the national CDC and, consequently, how much will be distributed to each district and community-level department.

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[31] This discussion of the material and specifically of documents, paperwork, patients being files, traverses both Chapters Four and Five.

“She’s not answering her phone”, implores Dr. Cheng (程). “She gave a false address to the designated hospital and she’s not returning my calls. Thankfully, she gave a real *hukou* number and I checked with the police station because I was so desperate. They say this Liu Wen is from Hubei but who knows where she is now. She’s registered at a *baomu gongsi* but when I spoke with them, she has long since moved companies. She didn’t return her sputum samples but her chest CT shows the infection to be quite advanced. She took the first round of medications but hasn’t been back. I have never even had the chance to meet her, let alone try to manage her treatment. It’s unfair if you deduct points for this patient.”

“OK, please come to the office tomorrow and we can discuss it further. There are other patients we need to revise too.” Dr. Cheng hangs up the phone feeling frustrated and nervous. But at least they listened, she thought. Putting down her phone, she exhales a sigh of relief.

THE EPIDEMIOLOGY OF TUBERCULOSIS: A DISEASE OF INEQUALITY

Many epidemiological particularities of Shanghai’s tuberculosis situation are embedded within Liu Wen’s experience of contracting and being diagnosed with tuberculosis and in the STP’s attempts to manage her treatment. The account further depicts how the municipality’s relationship with the wider country plays out epidemiologically. These dynamics are fundamentally determined and shaped by the decades-long *hukou* system.

Managing Movement: The Hukou *System*

The *hukou* system was first introduced in the 1950s. At the onset of the communist state, people’s free movement to and from the countryside and in and out of urban centres facilitated the country’s economic recovery. As a strategy to reduce unemployment and hunger in the cities, the government both coerced and assisted hundreds of thousands of wartime refugees and unemployed citizens to relocate to the countryside (T. Cheng and Selden 1994). In addition, landlords and rich peasants were required to repatriate to their original towns and villages of origin. Relocation was made more attractive by offering people land, and food and grain allowance. Restrictions were placed on re-entry back into the cities, however.

The government took up the responsibility of providing all urban residents with employment, food and subsidised housing – the above-mentioned work-unit or *danwei* system. This was in line with the communist state's development strategy, which was based upon the Soviet focus on heavy industry and used the rural to fuel industrialisation in the urban. Quoting Fan,

> The hukou system was one of the most powerful mechanisms of this peculiar path toward industrialisation, one that has been described as 'industrialisation on the cheap' because it fostered 'unequal exchange' between the agricultural sector and the industrial sector." (2008, 44)

It was assumed that the countryside was able to absorb an unlimited number of people and labour and, at the same time, that the agricultural surplus was sufficient to fuel the existence of those living in the cities. Feeding the farmers in the countryside was the responsibility of each locality and not the government's concern. Moreover, in times of famine, the government directed food to city residents, including those in the military, while residents in the countryside were assumed to have enough to eat. In reality, many more people died from starvation in the rural setting than in the urban centres during times of catastrophic scarcity. There was no social welfare nor insurance provided in the rural setting and with the restrictions on movement, the People's Republic had been divided into a 'one country, two societies' state, albeit moderately enforced in these early years.

In 1954, a police-administrative infrastructure was put in place and the state signed a directive entitled *The Directive Concerning Establishment of a Permanent System of Household Registration* in 1955. This new directive legislated the state's reach into the lives of its citizens. This was done primarily in three areas of food, employment and welfare (Fan 2008). Access to food is essential to determining one's ability to survive in a place. Knowing this, the government took control over urban food distribution in 1955. Control of goods such as cloth and other everyday essentials were soon included. The private marketing of food was prohibited and ration coupons were only available to those with a non-agricultural *hukou* as it was officially referred to – i.e., to those with an urban *hukou*– which meant that peasants were unable to survive in the city. Rather, those in the rural setting had to generate their own food supply.

Employment and welfare were intertwined into another way of controlling access to the basics of life. By 1957, the state had succeeded in obtaining ownership of all industry and commerce in the country through the establishment of rural cooperatives, the nationalisation of urban factories, and the creation of joint state-

private enterprises. Control of employment had been concurrently underway through the introduction of a centralised and strictly enforced system of labour allocation in 1954 called unified state assignment (同一分配; *tongyi fenpei*). Graduates were assigned to specific occupations and sectors, and workers were transferred to new jobs in accordance with the state's wider development plans. All urban workers were socialised into *danwei* through which the government provided the population with, as well as controlled access to, all the social welfare supports necessary for urban life such as food, education, healthcare (particularly in the form of medical insurance and primary care), pensions and subsidised housing for employees and their families. Under the system of *tongyi fenpei*, urban *danwei* were prohibited from recruiting from the rural setting and from employing peasants, i.e., they could only employ those with a non-agricultural *hukou*. Job mobility was low and the job market had been eliminated.

Control over the most essential aspects of survival also ensured control over human movement. The enforcement of this directive was flexible at first, especially during the urban construction boom when there was an increased demand for labour in the cities. However, the government commenced the full and strict implementation of the *hukou* system during The Great Leap Forward campaign (1958-61) in an effort to regain control over society and the economy. Faced with catastrophic famine, peasants flocked to the cities in search of employment and, more importantly, food. Twenty million workers were exiled from cities during this time (T. Cheng and Selden 1994, 666). The divide between countryside and city had become impermeable and immovable, and remained that way until the late 1970s with the end of Maoist period.

There have been various relaxations and reforms of the *hukou* system since the Reform and Opening period or *gaige kaifang* (改革开放; 1978 – present). With the reopening of markets, it became possible for peasants to obtain food in urban settings. Migrants today can obtain a temporary residence permit (暂住证; *zanzhuzheng*) to live in a city. Citizen identity cards, which can now be used in addition to the *hukou* passbook, have streamlined movement throughout the country. Most recent reforms have included the commodification of *hukou*, allowing coveted urban *hukou* for centres such as Shanghai or Beijing to be bought or even offered like green cards to desirable individuals with the proper credentials, income, etcetera in the form of a 'new resident's card'. These criteria for eligibility make them effectively only available to those with certain financial and social capital means, such as select elite Chinese persons, overseas Chinese, and foreigners. In Shanghai, blue-collar (蓝

印; *lanyin*) *hukou* were issued to skilled and qualified migrants from 1993 onwards, which were later converted into full residence permits (居住证; *juzhuzheng*) in 2002 (Roulleau-Berger and Lu 2005). For the vast majority of unqualified migrant workers however, even with the relaxations and reforms, the *hukou* system continues to control and dictate their access to the essentials of life in these urban centres, such as restricted or even prohibited access to welfare, pension, subsidised housing, education and, as we will see through examining the tuberculosis epidemic and its management, healthcare.[32] The *hukou* system is a population and mobility control apparatus that, in the Shanghai context at least, produces two forms of inequality:

> the first of these distinguishes citizens from migrants, and the second distinguishes migrants with few cultural and economic advantages from those with skills or financial resources. (Ibid., 2)

Mobility and Inequality

The challenges faced by Liu Wen are those that make up the experiences of a significant demographic in China today called the floating population (流动人口; *liudong renkou*). This is the largest and most mobile migrant population in the world. Now totalling almost 376 million in 2020, as recorded by the National Bureau of Statistics of China,[33] the floating population is comprised of individuals who temporarily work or reside in locations different from their *hukou*. These are typically rural-to-urban migrants and of lower socio-economic status who may change their place of work and residence with unpredictability.[34] They are not entitled to social benefits such as education, welfare nor healthcare in their non-*hukou* place of residence unlike their local *hukou* counterparts. The floating population's characteristic mobility poses one of the biggest challenges to both China and Shanghai's tuberculosis programme, with the issue of human mobility a confounding factor for tuberculosis control globally (WHO 2016).

Tuberculosis was previously more prevalent in the urban setting during China's industrialisation period and, as mentioned above, was regarded as a disease of

[32] See, for example, Mao (2023), Cheung (2012) and F.-L. Wang (F.-L. Wang 2004) for more on the later development of *hukou*.

[33] http://www.stats.gov.cn/english/PressRelease/202105/t20210510_1817185.html

[34] More recent research has identified a portion of this population now consisting of talent migrants and their trailing spouses, children and elderly parents who typically reside in one place. These 'floating' talent migrants are "well-paid and upwardly mobile" (MacLachlan and Gong 2022, 1) in comparison to the more traditionally assumed rural migrant worker with low socio-economic status.

capitalism. Today, the highest rates of tuberculosis are found in the rural setting due to a circulatory relationship between the city and the countryside mediated by the floating population.[35] Apoliticised, tuberculosis is now described as a disease of poverty.[36] Leaving their rural hometowns in search of work in the city, migrant workers often have limited education and training, and usually perform physically demanding jobs that involve manual factory or service work for long hours and with low wages (e.g., Shen et al. 2012; Solinger 1999). Accommodation may be provided by the employer in the form of dormitories with poor ventilation and/or hygiene, as well as limited cooking facilities, if any. *Baomu* like Liu Wen may try to find a live-in position so that accommodation and food are provided for by her employer. However, many prefer to work for a number of households as, in this way, they can earn more money and retain their freedom to move around the city – we can infer that Liu Wen was engaged in the latter as she was anxious about being late for her next appointment when getting the bus. Those like Liu Wen may then choose to rent a shared living space or, in order to save money, live in the *baomu gongsi* dormitories, which are significantly cheaper and run on a pay-as-you-stay system. Human traffic is high here as *baomu* come and go according to their work schedules. These shared spaces are noisy, often poorly ventilated environments with communal bunk beds, where endless games of *mahjong* (麻将) are played and,[37] again, with limited cooking facilities.[38] Food bought for cooking is usually of the cheapest kind bought at the food market so as to save more money to send home. Predictably, rest and nutrition, and therefore immunity, are compromised from residing in these settings.

In terms of access to healthcare, Shanghai's tuberculosis programme did not previously include migrant workers. All expenses had to be paid out of pocket and migrants were only eligible for free treatment if they returned to the place of *hukou*. Many did not return to their hometowns for treatment, however, but continued in Shanghai taking sporadic and variable treatment, which fuelled the municipality's infection rates. Aware of this reality, SCDC personnel petitioned for the inclusion of migrant workers in the free treatment policy and, after successive attempts, were finally successful (see Interlude: Director Mei for more). In 2004, the free treatment for tuberculosis was extended to anyone who received a diagnosis, regardless of their

[35] Tuberculosis rates in the rural setting are estimated to be twice times that in urban centres (Shen et al. 2012).
[36] Poverty is an indisputable and powerful social determinant of tuberculosis. However, throughout the thesis, I choose to refer to tuberculosis as a disease of inequality to highlight the far from apolitical nature of its epidemiology.
[37] A tile-based game for four players.
[38] Recent years have seen the Shanghai government prohibiting such cohabiting conditions, however, as part of public health and fire safety measures.

place of *hukou*. However, other aspects of the Shanghai programme confound the ability of migrant workers to avail of the policy. Once diagnosed with tuberculosis, the patient's employer is to be notified and the patient is not permitted to work until they are confirmed as being cured, with their employer to keep the patient's position until such time. In practice, however, employers are unwilling to employ, let alone keep the position of an absent worker, for nine-plus months and the patient often loses their job. This is why many patients may choose to give a false name and address in order to avoid losing their job. Other patients may do so to avoid meeting with public health doctors at their place of residence or work and being pinned with the stigma associated with a diagnosis of tuberculosis. Similarly, schoolchildren who are diagnosed with tuberculosis are prohibited from attending school until they are pronounced cured and close-contact screening is mandatory upon diagnosis.

In addition, Shanghai's 'free' programme stipulates that the patient pay for all medical expenses first and be reimbursed later at the point of cure. For those who give correct names and addresses, it is unlikely that they can pay for nine-plus months of medical expenses when they are not permitted to work. Aware of this predicament, community doctors arrange for some patients to be reimbursed on a monthly basis rather than at the point of cure, which makes continuation of treatment more manageable for some. However, the policy only reimburses the most basic aspects of treatment: the whole course of first-line drugs, sputum smears and cultures, x-ray scans, and blood and liver function checks. It does not cover hospitalisation fees (which are notoriously hefty), second-line drugs or any other medications or medical examinations – the cost of liver protection drugs is not included when liver damage is one of the primary side-effects of anti-tuberculosis drugs and cause of treatment default. Moreover, chest CTs were commonly requested by doctors in place of x-rays at the point of diagnosis during my fieldwork, which are not covered. A maximum total of 1,300RMB is allocated to each patient through the free treatment policy in Shanghai, with final medical bills often totalling much more (X. Wei et al. 2009; see Chapter Four for more on reimbursement)

Shanghai's programme further includes migrant workers in its DR-TB policy. Due to the prolonged nature of DR-TB treatment and the financial stress this puts on patients who are effectively unemployable by virtue of being a recipient of the policy, patients were previously given a monthly allowance of 500RMB to cover expenses and food to maintain nutrition and immunity. In a city like Shanghai, this amount is not much but it is something. However, it was discontinued when the Global Fund completed its ten-year project funding DOTS for DR-TB in China and patients were left without any income. Today in Shanghai, only the district of Pudong New Area is able

to provide its DR-TB patients with a monthly allowance. As one can imagine, the combination of no job, no allowance or income, and pay-first-reimbursed-later leads to many patients defaulting and disappearing, unable to be found even if enquiries are made with the CDC in their *hukou* province. Patients who do go to their hometown may not want to notify their local public health institutions for the same reasons of stigma, control and employment described above. Health professionals often complained of being powerless when non-compliant patients disappear and cannot be found in these instances.

The nuances of the tuberculosis programme and how it compels the relationship between the city and the countryside mediated by the floating population has resulted in higher prevalence in the rural setting. Migrant workers are more likely to contract tuberculosis in the urban setting and then, being unable to work or subsist, may choose to return to their hometown for treatment and may or may not notify local health authorities. In this way, their treatment may be variable and/or incomplete, and the local health infrastructure may not detect these discrepancies. The majority of tuberculosis patients are migrant workers for whom it is exceedingly difficult to remain in Shanghai without income. These individuals may return to their hometown, which is most likely located in a rural setting and, in this way, infections acquired in the city are brought to the countryside where they may or may not be treated successfully or even be detected by local health authorities. Patients with advanced and difficult-to-treat cases may then return to the city seeking better doctors and treatment than those available in their *laojia*. Cities like Shanghai and Beijing have the highest concentration of health experts in the country as well as two of the national chest hospitals.

The implications of mobility for an airborne infectious disease make the floating population one of the biggest challenges for tuberculosis control. This is compounded by the increasing number of first-time DR-TB infections. Faced with patients who may refuse treatment, become unknown within the system, and, presumably, continue to move around, work and run the risk of infecting others, some health workers have called for involuntary incarceration as a desperate measure. They point out that U.S. public health law already permits this. Health professionals also expressed how they do not have the *quan* (权; *power or authority*) to legally obligate patients to comply with their treatment. I found myself sympathetic when they expressed their frustrations and conclusion that some patients are just bad (坏; *huai*) and irresponsible (不负责任; *bufu zeren*), leading them to work off the assumption that these individuals prefer to spread their disease to others without caring. I bore witness to how this, in

turn, influenced health professionals' understanding of their work and how they carried it out. Policy that fails to attend to the social, political and economic determinants of disease leaves little room for other modes of treatment bar the enforcement of pharmacological treatment and patient compliance. Health professionals can come to judgements such as the above when they feel they have run out of options and when patient non-compliance not only endangers the wider population but also affects their work performance ratings, salaries and professional relations (see Chapter Five for more on labour). In such instances, although not in China, public health control has resorted to involuntary incarceration in its attempt to manage patient mobility (see Chapter Three for more on involuntary incarceration).

The other significant demographic challenging tuberculosis control in Shanghai is the elderly. Having lived through the Maoist period and endured hardship and poverty, many may have latent tuberculosis infections (LTBI) contracted pre-1990s that then become active with advancing age and lowered immune resilience. Generally, patients with rural *hukou* tend to be younger migrant workers who come to work in the city, and patients with local *hukou* are usually elderly long-term residents of the city. This distribution can be mapped out geographically as well as epidemiologically, with the concentration of migrant worker patients located in the suburbs, where rent is cheaper, and the majority of elderly patients within the city's downtown, where these residents have lived for decades and own their own property. This also means that districts further from the city centre, such as Pudong, Songjiang and Jiading, have many more patients to manage than downtown districts as rental prices are cheaper further from the city; presumably, those who can afford to rent in the centre of the city are also less likely to be nutritionally deficient.

Following the urban development and resettlement *chaiqian* (拆迁; *demolition*) policy (e.g., O'Brien and Deng 2015), most elderly still living in downtown are likely to be financially comfortable having received compensation from the government for their home. C.-Y Zhang et al. (2019) have found that being from a rural setting and having a lower income are risk factors for LTBI in the elderly nationally. This means that the number of elderly patients is lower in Shanghai – a major urban centre – than in other parts of China. However, the elderly still totalled some 16.3% of Shanghai's population in 2020;[39] a number made even more significant when considering that China possesses the world's largest elderly population and one that is steadily growing. Since 2014/15 when this fieldwork was carried out, China has seen an

[39] https://www.statista.com/statistics/1130402/china-shanghai-population-distribution-by-broad-age-group/

epidemiological shift from younger to more elderly incidences of tuberculosis infection due to an ageing population, longer life expectancy, and reactivated infections (J. Cheng et al. 2020).[40] Chinese health professionals have highlighted the need to adjust national tuberculosis control programmes to address this epidemiological shift (Ibid.) and for the development of vaccines that specifically target the elderly (Y. Wang and Wang 2019).

CONCLUSION

This chapter has told the story of China's evolving relationship with the rest of the world, as played out through the historical development of its public health system and tuberculosis programme since the Maoist era. An insistence on communist ideologies around the (Soviet) body and collective healthcare has given way to the state's increasing withdrawal from the areas of public health funding and provision. Rather than a communal drawing from the 'iron rice bowl', a series of health reforms since the late 1970s has shifted the responsibility of ensuring healthcare and its provision onto the individual. This is in line with the increasing privatisation of healthcare seen worldwide. Moreover, China's adoption of the CDC model in 1998, with increased 'respect' paid to public health following the 2003 SARS crisis, has cemented its commitment to the technocratic approach in managing the public's health and epidemic preparedness. No longer 'the sick man of Asia', China has publicly proclaimed its presence on the global health stage, and as an equal, with the country funding more and more of its own health programmes.

The chapter has also traced how the socio-economic and political determinants of health are profoundly relevant for understanding tuberculosis control in this local setting. It has introduced the metropolis of Shanghai as a site with a long history of public health and tuberculosis control efforts, It has identified the challenges facing the majority of patients – that of social and economic instability and inequality – and demonstrated how they impact patients' experience of treatment and recovery. In China, one's socio-economic stability is profoundly influenced by one's political status or *hukou* and the chapter has further discussed how the political is deeply entwined with governance, access to welfare, and one's ability to recover from illness.

[40] A retrospective study conducted by the SCDC and Fudan University and two U.S. institutions found that of 5.3%of successfully treated cases of pulmonary tuberculosis between 2000 - 2012 in Shanghai, 95% of them went on to experience one or more recurrences of infection (Shen et al. 2017). This problematises what we can assume to be 'cure', particularly in light of the characteristics of today's epidemic, which include relapse and drug-resistant infections (Venkat 2018; Chapter Two will discuss further).

By examining these details, the chapter has explored how the social, economic and political complicates pronouncements and judgements of '*huai*' patients who are non-compliant and are therefore 'bad'. There may be other reasons why a patient chooses to adhere or not adhere to their treatment.

The experiences of Liu Wen exemplified some of these reasons and the *maodun* inherent in the technocratic management of a disease of inequality. She sought out healthcare on more than one occasion and wanted to be in good health, if only so that she could keep working. However, the same policy that is to aid her recovery makes it impossible for her to survive in Shanghai long enough to recover. If she were to adhere to the policy, she'd have to first pay for her medications and treatment spanning months and then be reimbursed when she is cured. However, and at the same time, she is also not permitted to work until she is pronounced cured, which confounds her ability to pay for medications and treatment. Migrant workers comprise the majority of tuberculosis patients, who are often engaged in informal or precarious employment. Moreover, their non-local *hukou* denies them access to social or medical welfare, making their medical financial burdens even heavier – much heavier than those of local *hukou* patients. The socio-economic and political conditions faced by Liu Wen and many other tuberculosis patients may result in *maodun* that compels choices that do or do not adhere to policy and protocol.

Interlude: Dr. Liang

Veteran Tales from a More Rural Shanghai

Dr. Liang (梁) sat tall and straight across the table. He held his posture with poise and his head high. He had a serious countenance and a neat professionalism that gave way to warm humility. Like when I expressed awe at learning that he spoke five languages; among them, English, German and Russian. Indeed, we had already been conversing in part Mandarin and part English; Dr. Liang's medical and technical vocabulary was as fluid as before his retirement. I had the pleasure of meeting him on Veteran's Day: an annual celebration held by the SCDC to thank the retired old hands (老手; *laoshou*) who had dedicated decades of their lives to the task of tuberculosis control in Shanghai. After the festivities had finished, we'd remained in the meeting room for an interview.

Listening to Dr. Liang speak, I came to picture another Shanghai. Not the high-rise, fast-paced, ultra-urban metropolis I had come to know, but a slower, less shoulder-to-shoulder, and, in parts, rural place where one could see far into the distance – the low-rise landscape allowed one to observe how flat Shanghai actually is. Dr. Liang had a long career, beginning in the 1960s and worked through the Maoist and Reform periods until well into the new millennium. He graduated in medicine from Shanghai Medical College and had always specialised in tuberculosis. He knew and had performed every aspect of its control. He was a clinical doctor, a classical epidemiologist, and read sputum smear slides to evaluate and manage treatment regimens. He was also in the community – in the fields and farms that were Shanghai – carrying out active screening, patient diagnosis, and in-home BCG vaccination for children. Later, with the shift to the CDC model and separation of clinical and preventative work in 2000, Dr. Liang performed the latter duties only and solely in the urban setting. He was exceedingly familiar with the development of tuberculosis control in Shanghai. He was also encouraging of my asking so many questions.

"Young people should try to learn everything. It's very important", he advised me.

Dr. Liang: In the 60s, us doctors and public health nurses went with a simple x-ray machine into the countryside to find patients. A small one, thirty milliamps (mA), handheld and mobile for taking x-rays and fluoroscope to find patients.

Ting Ting: Were these the x-ray cars?

Dr. Liang: No, by the time there were cars it was already very advanced. We just carried it by hand, thirty mA, it was very small. The machines today are all at least 200mA or 500mA. I used a very simplified one of thirty mA, the country was still poor then. I worked in the rural areas, Shanghai had ten counties [县; *xian*]then and it was all farmers.[41] We'd go to [the farmers'] homes for the BCG vaccination.

I was [working for the] Shanghai TB control centre and the government mandated that we had to go to the countryside to visit the farmers every three to four years. Not like now, they don't do that now, it's not good. We'd go three to five doctors at a time for one year. That was our generation of tuberculosis health workers. We achieved huge results, all through a lot of effort. Our exposure to the x-ray machine was huge, even with an apron. We were exposed to 200-300 people [and thus x-rays) every day. [By the time of the] car it was much better. The car gave protection from the rays. Then we would x-ray 500-800 people in 1 day, mass mobile radiograph, *kota, kota* [mimicking shutter sound] one after the other. In the sixties and seventies, it was all like that. There are still some of those cars in use today, but not many.

Dr. Liang spoke of how serious Shanghai's tuberculosis epidemic was before the 1960s. He told stories he'd heard from the 1950s from his older colleagues.

Dr. Liang: Then, when the patients came in, they always came in an emergency. There was no prevention or treatment of TB, it was just deaths from TB. They couldn't care of them, there was nothing they could do. All they could do was give them food. There was no thinking around prevention.

His colleagues encountered patients pale and coughing blood. Sometimes they were sprayed with blood from the patient coughing so severely. He described how, then, it was entire families and because they were mostly farmers, they often didn't have money to see a doctor. He gave examples of parents who sent their child to the doctor and then forfeited eating themselves to pay for their child's recovery. Some

[41] Today, in 2023, Shanghai is composed of sixteen districts rather than ten counties.

didn't eat and gave their food to their children. Often, in these cases, both parents died and the children would be orphaned.

Dr. Liang: In 1950, one bottle of streptomycin was the price of one hundred grammes of gold. This was very early on. Streptomycin was first discovered in Switzerland in the 1940s/50s. But by that time [in the sixties when he was working] it was sold very, very cheaply. It became one RMB for one bottle. One to two RMB for a bottle, and the same later for isoniazid. It was this price after the sixties and into the seventies.

So that was the policy then. Health professionals had to bring healthcare to the rural areas. Regardless of what kind of person he was, I respect that policy.[42] They don't do that today. It was better before when we had to go to the countryside. But incidence is lower now and mass examination is unnecessary. Then it was all active case finding, patients didn't know to come to us. Our country's education was very poor and levels of education were also very low. The country didn't tell people to get checked.

Dr. Liang then commented on how treatment is now free in China. Even the scans and tests that have become so expensive are free for a tuberculosis patient – the country pays for it. The success they achieved during the twentieth century has meant that there is now only one main pulmonary hospital in Shanghai for tuberculosis instead of three. Patients are well enough to recover at home instead of having to stay in hospitals for the duration of their treatment. These changes have meant that it is the patient's responsibility if they choose not to avail of policy to recover. But nonetheless, Dr. Liang commented that health professionals also have a responsibility as it is their job to cure them, to monitor them, to encourage them.

Dr. Liang: I needed to regularly keep on them because I had to cure them. If I didn't cure them, they would spread it to others.

But he acknowledged that that may not be the approach now.

Dr. Liang: People are different now. They wouldn't care so much. You don't have people like our generation now.

[42] That is, Mao Zedong and his policies.

In drawing our conversation to a close, I remarked again on Dr. Liang's polyglot talents. Dr. Liang explained that the former was a subject he took in middle school for three years "during the honeymoon period between Russia and China". German came later, when he worked as a clinical visiting doctor in a pulmonary department in Dusseldorf for a year and a half. His fluency was down to that time spent cultivating medical experience, coupled with night classes before he left.

Ting Ting: How did you find practising medicine in Germany compared to in China?

Dr. Liang: I think in Deutschland, the doctors mostly depended on machines.

Ting Ting: What machines?

Dr. Liang: Everything! The chemotherapy machine, and x-ray machine, the endoscope. But Chinese doctors depend more on thinking. I think in Germany it was more of a reliance on what can be understood as evidence-based medicine – things were either good or not good. Chinese doctors include experience, they have to think. They depend on both machines and experience.

Chapter Two

The Laboratory Technicians: Negotiating Human-Microbe Relations

> in the whole of TB control work, the laboratory is truly the leader. Why do I say this? Our leaders insist that we must carry out successful case-finding, and what is case-finding dependent upon? The laboratory. Its purpose is to identify the infectious agent [传染原; *chuanranyuan*].
>
> You can't find the infectious agent in the scans; you can only do this through lab work. And especially as the WHO stipulates etiological findings, only by identifying the infectious agent can you etiologically determine an incidence of TB. Even if you look at the lungs, this is only a clinical diagnosis, not a confirmed one [确诊; *quezhen*]. So the lab is the leader [主导者; *zhudaozhe*]. Furthermore, there can't be any preventative work or clinical treatment without the lab results. If your lab results are unclear then how can you take action? That is to say, if your diagnosis is not clear then how do you treat?
>
> Even the term 'case-finding' means identification of the infectious agent. No lab finding means no prevention and no treatment; only if you find the infectious agent can you start treatment. And what is treatment? It is control of the infectious agent. How do you control it? You have to cure [治愈; *zhiyu*] the patient, and you can only do this by annihilating [消灭; *xiaomie*] the infectious agent.[43] You have to kill them all.
>
> (Dr. Hong, follow-up interview, 2019)

According to Dr. Hong's explanation, you've got to know the microbe in order to cure the disease. This is true whether it's clinical or public health medicine, and in this specific case, it's true for controlling tuberculosis. In fact, the entire purpose of DOTS is the systematic and standardised identification and 'annihilation' of the infectious agent: the bacterial microbe, *mycobacterium tuberculosis*. And there is only one group of people able and authorised to confirm that these fundamental tasks have been carried out: the laboratory technicians.

Laboratory technicians know *mycobacterium tuberculosis*. They know it because they can *see* it. It: the microbe itself. Unlike clinical physicians who may observe how the bacteria present as symptoms in and on the patient's body, laboratory technicians wield technologies that enable them to behold the presence of the rod-shaped entities responsible for chronic and consuming illness. They can see

[43] I interpret Dr. Hong's use of 'annihilate' as drawing upon Maoist rhetoric and its use in the area of disease control and elimination (Rogaski 2002).

its form, measure its composition, identify its specific strain, study how it reacts to drug treatments, and how it adapts and becomes resistant to some, or all. They co-exist in communal spaces with the microbe and they interact with it in highly controlled ways. They use tools to examine it, manipulate it, and even grow more of it in test tubes or within the lungs of laboratory test animals. Tuberculosis the disease exists because *mycobacterium tuberculosis* exists, and it is the laboratory technicians who declare it so. Without their sign-off, a patient can, at most, only be suspected as having been infiltrated by the infectious agent. Clinical judgement and medical scans combined are not enough to trump what must be seen by trained eyes on a stained slide through the lens of a microscope. Technology plays a central role in making it possible to know the microbe.

This chapter explores the work of the laboratory technicians who make tuberculosis knowable and, as a result, controllable in Shanghai. The pivotal position they occupy makes understanding their role and how they carry it out a cornerstone in making sense of how DOTS works in the metropolis. Moreover, insight into these interstices that laboratory technicians occupy and negotiate broadens considerations of human-microbe relations beyond the simplistic assumption that microbes are static and antithetical to humans, and that we must kill them all. Rather, humans and microbes have become together, intra-acting (Barad 2007) through time within a common ecology, shaping each other ceaselessly (Clark 2010), and will continue to do so. The individuals in this chapter demonstrate how they have come to cope with the microbial both professionally and personally. Examination of their work in context further casts light on how *mycobacterium tuberculosis* is imagined and managed as per a modern global health programme, such as DOTS. Implicit within the design of this programme are tacit assumptions in relation to the kind of modern state that is able to implement such an approach: one equipped with a public health system that has the knowledge and technological capability to manage microbes safely and professionally.

The following will first introduce the historical development of biosafety capability in China. Infectious microbes must be managed in a controlled and safe manner and China's spirited installation of these specialised facilities represents a significant step towards demonstrating their status as a modern state. Major investment in epidemic preparedness commenced following the mishandling of the SARS crisis in 2003 (K. Mason 2016a), to the international chagrin of China. As many of my interlocutors have stated, it was then that the government started to respect (尊重; *zunzhong*) public health. Part of this respect came in the form of providing proper

facilities, technology, personal protective equipment, training, and standardised protocols for working in laboratory settings. Armed with these tools, laboratory technicians could then form part of the infantry with which a technocratic China (Andreas 2009) could march into the global health arena as an equal contender. Today, China is regarded as one of the world's 'Big 5 leading science nations' and features in the same category as the United States, Germany, the United Kingdom and Japan (Crew 2022).

The second section brings us back to contemporary Shanghai and explores the everyday work carried out by the city's laboratory personnel enacting DOTS. It then describes and discusses three scenes. From these moments, we learn further details of what is entailed in carrying out DOTS-related work; the experience of navigating a biosafety level three (BSL-3) laboratory; and a technician's reflections on how laboratory work becomes habituated over time. The central role played by technology in enabling technicians to carry out testing, culturing, and the work of seeing and knowing is a constant throughout the three moments. All recent advances in managing tuberculosis have been predominantly made in the area of rapid diagnostics, with discourse on further necessary developments limited to the microbiological work of new drug treatment and vaccine development only – social and economic concerns continue to be notably amiss. Laboratory technicians, with their ability to wield these technologies, have come to be infused with society's hope for better futures that only these experts, with their knowledge and skill, can bring about.

The highly specific conditions within the space of the laboratory make it a kind of no man's land: where the behaviour and freedoms of humans and microbes alike are suspended, curtailed and controlled. Laboratory technicians (be)come to embody a sensibility in how to negotiate human-microbe relations in real-time within this interstitial space. Again, technologies are fundamental to mediating these social encounters. The incorporation of their use shapes how we interact with and come to conceive of microbes and of ourselves in relation to them. The chapter closes with a final reflection on what the preceding discussions inform us about ongoing human-microbe relations in terms of the threat of danger and feeling of abjection towards the weird and the eerie.

BUILDING BIOSAFETY IN CHINA

The building of China's modern biosafety system began in earnest in 2003 following the SARS crisis. The epidemic revealed the unprepared and disconnected system extant and in its disarray. Further disease outbreaks of H5N1, H1N1, H7N9, and MERS (Middle East Respiratory Syndrome) compounded the need for increased capability. The Chinese term for biosafety, *shengwu anquan* (生物安全), refers to the framework of physical infrastructure, safety equipment, personnel training, standardised practices, and legal regulation to ensure protection for health professionals, the community and the environment "from the risks and hazards caused inadvertently by working with microorganisms and toxins" (Cao 2021, 2). The recent Biosafety Law of the People's Republic of China, approved in 2020 and which came into effect in 2021, asserts that,

> biosafety is an important part of national security…this law is formulated in order to safeguard national security, prevent and respond to biosafety risks, protect people's life and health, protect biological resources and ecological environment, promote the healthy development of biotechnology, promote the construction of a community of shared destiny for mankind, and realize the harmonious coexistence of man and nature. (Han 2021, 95 quoting the legislation)

The development of biosafety capabilities is as much a political matter as a practical one and China has been performing the development of its technical power through a number of channels since 2003.

The first Office of Laboratory Management was set up in 2004 within the recently established Beijing CDC in 2002. It redesigned the extant system according to the values set by the newly adopted CDC model of public health management. The country embarked on the comprehensive centralisation and standardisation of "the scattered and disorganised condition of laboratories" (G. Wu 2019, 56). Infrastructurally, a series of specialised biosafety level (BSL) laboratories have been constructed, totalling some forty-two BSL-3 and the completion of one BSL-4 laboratory in Wuhan. Already existing BSL-2 laboratories were renovated and received more equipment and resources.[44]

The first laboratory biosafety (hereafter LB) textbook was published in 2005 and the first national training for laboratory instructors was held within the same year.

[44] Biosafety level laboratories have in-built biocontainment precautions that allow for the safe handling of infectious or contagious materials. Strict protocols for operating in these spaces is another precaution measure and must be followed. There are four levels of safety (see https://www.niaid.nih.gov/research/biodefense-biosafety-labs for more information).

This knowledge was disseminated in 2006 when these qualified instructors held on-site trainings for their own institutions. 2008 saw a further attempt at the standardisation of personnel training through the creation of a video on *LB of Pathogenic Microorganisms*, which was circulated nationally. These trainings are repeated annually along with those for new techniques as they become relevant.

The Chinese National Accreditation Service for Conformity Assessment (CNAS) was established in 2004 as a formalised body of third-party recognition for Chinese laboratory biosafety standards (Zhai et al. 2019). Accreditation bodies judge a laboratory's ability to enact risk assessment and risk control; they set a standard for assessing managerial and technical capability. Legislatively, there have been calls for China to develop biosafety laws since it started to develop biotechnology in 1980. The recent outbreak of the SARS-CoV2 (COVID) in 2019 intensified that urgency and the above-mentioned Biosafety Law, which covers the issues of biosafety, biosecurity, and public health preparedness, is the result of these urges.

In 2018, China began holding annual meetings to further consolidate its national integration and the reach of its international engagement. The first Global Biosafety Symposium was held in Beijing in 2018 and, notably, it was attended by national bodies and professionals only (Xu 2019). The second gathering sent a very different message. It was held at the Wuhan Institute of Virology, home to China's first BSL-4 laboratory, and had much more of an international focus. Communique on a workshop on biosafety laboratory management and techniques boasted some twenty-four participants from twenty-two different countries; their Chinese counterparts were not mentioned in the write-up, however. Many of these countries were notably not from the more affluent global north or west and the workshop addressed the issue that,

> most developing countries lack biosafety facilities, qualified personnel, and sufficient funding for infectious diseases research despite dealing with higher levels of risk from different infectious diseases. Therefore, the workshop aimed to provide a good opportunity for participants from developing countries to acquire more knowledge and experience in biosafety, which will enable them to strengthen the biosafety capacity in their own countries (H. Wei 2019, 10).[45]

Further making its presence felt internationally, China has collaborated with established global institutions, such as the WHO and the European Biosafety Association (EBA), to demonstrate that they have the ability to engage in research

[45] These countries included: Pakistan, Bangladesh, Bulgaria, Poland, Cambodia, Cameroon, Croatia, the Democratic Republic of Congo and Egypt (H. Wei 2019, 10).

conducted to international standards. Donating mobile and constructing fixed BSL-3 laboratories in Sierra Leone during the Ebola outbreak showcased China's rise in biosafety prowess and asserted that they are no longer only a recipient but also a giver of highly specialised aid.

The development of biosafety infrastructure and expertise is directly linked to the established Party tactic of drawing on the belief in and use of scientism and technicism to legitimise its political ideology, bolster power, and further policy. There is a long history of 'governing through science' in China (e.g., see Greenhalgh and Zhang 2020 for more discussion). In the area of microbiology, China has made it clear to its citizens and the international community that it plans to become a leader in genetic research by supporting work in genome sequencing (Cyranoski 2016b) and editing (Cohen and Desai 2019), as well as through the construction of a major genetics bank (Cyranoski 2016a). Thus, the country's advancement in biosafety capabilities is of global interest. International attention and trepidation ensued coming up to and following China's establishment of its first BSL-4 laboratory (Cyranoski 2017), making it 1 of only 59 BSL-4 laboratories that exist in the world.[46] Further plans have been finalised to enact the,

> formation of a national system of high-level biosafety laboratories with scientific layout and network operations by 2025; the building of five to seven BSL-4 laboratories, as well as the establishment of a new batch of BSL-3 laboratories to achieve the goal of having at least one BSL-3 laboratory in each province (Huigang et al. 2020, 26).

With the Biosafety Law now in effect and the country's continued efforts to expand its biosafety network, China is asserting its dedication to international standards of biosafety practice and preparedness, and that it stands on equal footing with the rest of the international community, if not one step ahead.

[46] These 59 BSL-4 laboratories are located within 23 countries. Europe has twenty-five; the U.S fourteen, Asia has thirteen; Australia four; and Africa three. (see https://theconversation.com/fifty-nine-labs-around-world-handle-the-deadliest-pathogens-only-a-quarter-score-high-on-safety-161777 and https://www.globalbiolabs.org/map for more information).

WHAT LABORATORY TECHNICIANS DO

> TB laboratory examination is the most important approach to identifying the infection sources, providing key evidence for definitive TB diagnosis, selection of treatment regimen and evaluation of efficacy. *The quality assurance system is a key step towards ensuring the accuracy and reliability of laboratory findings*. In order to protect the operators, the environment and the test specimens, all operations at TB laboratories should be done in an environment with the appropriate biosafety level.
>
> Guidelines for Implementing the National Tuberculosis Program in China (Yongjie Hu, Duan, and Li 2008, 12 emphasis mine)

The work of Shanghai's laboratory technicians begins with three sputum samples (see Table 4 for a flowchart of the following). If an individual visits a designated hospital and is suspected of tuberculosis infection, they undergo a chest x-ray and are asked to give a sputum sample for smear testing. If their sample is found to be sputum smear positive (ss+), the individual is diagnosed with tuberculosis and prescribed medications to take home or admitted for inpatient treatment, depending on the severity of their infection. The now patient is given two specimen cups, labelled with their name and a barcode, to collect the two subsequent samples and, if they do not require inpatient treatment, are asked to return these to the designated hospital clinic for analysis the next day. Patients are also asked to ensure that they provide samples that are "sticky and suppurative coughed from the lungs" (Yongjie Hu, Duan, and Li 2008, 30) as diagnosis can only be made from this substance and not from other fluids such as saliva or sputum stained with blood, for instance. The patient is thus required to provide three specimens of the substance they cough up from within their lungs: one 'on-the-spot' sample during their initial consultation, one that evening, and one first thing the next morning upon rising. All three samples undergo sputum smear testing using smear microscopy in the on-site laboratory.

Sputum smear testing is carried out in a BSL-2 laboratory and entails smearing sputum across a slide and then staining it in order to render *mycobacterium tuberculosis* visible to the human eye. A Ziehl-Neelson (Z-N) staining method that shows up acid fast bacilli (AFB) is used, as per WHO guidelines.[47] After the stained slide is dry, the technician places it under a microscope to see if there is rod-shaped life present and, if so, how many there are. These rods are counted, with the presence of bacteria determining whether the test is smear positive or negative; that is, whether

[47] Other methods that match or improve upon Z-N staining in terms of accuracy, rapidity and reduced observer fatigue include fluorescent (FL) staining (Bhandari et al. 2021), Auramine staining (Hooja et al. 2011), Gabbet's staining (Sharma and Nagmoti 2021) or even newer double staining methods being investigated by Chinese laboratory technicians (Che et al. 2016).

or not the patient has a confirmed diagnosis of tuberculosis infection and, if so, its level of infectivity. Smear testing is carried out again at the second and fifth months of treatment, or more often if required by the physician, in order to assess treatment efficacy; if the treatment is effective, then the volume of bacteria should decrease as the treatment progresses. Confirmation of no bacterial presence is necessary to determine and diagnose cure – that is, when all the microbes have been annihilated. Sputum-smear testing is reported according to the following criteria and definitions:

> AFB (-): no AFB is found in 300 consecutive fields;
>
> Number of AFB reported: 1-8 acid fast bacilli/300 fields;
> AFB (1+): 3-9 acid fast bacilli/100 fields;
> AFB (2+): 1-9 acid fast bacilli/10 fields;
> AFB (3+): 1-9 acid fast bacilli/field;
> AFB (4+): ≥10 acid fast bacilli/field.
>
> At least 300 fields should be observed before reporting the result of AFB 1+, and 100 fields for AFB 2+, and 50 fields for AFB 3+ or 4+.
>
> (Yongjie Hu, Duan, and Li 2008, 20)

A corresponding barcode is attached to each slide. This links the smear results to the patient's file and can be accessed through the hospital's intranet system. The information is further reported onto the municipal-wide online platform and accessible to personnel with permission.

Patients found to be sputum smear negative (ss-) but suspected of tuberculosis from clinical examination are started on anti-inflammatory treatment for two weeks. If they show improvement on these drugs then they are excluded from a diagnosis of tuberculosis. Patients who do not show improvement after two weeks will receive standard drug-susceptible antibiotics and further observed. Improvement on this regimen will confirm a diagnosis of tuberculosis and set subsequent protocol in motion.

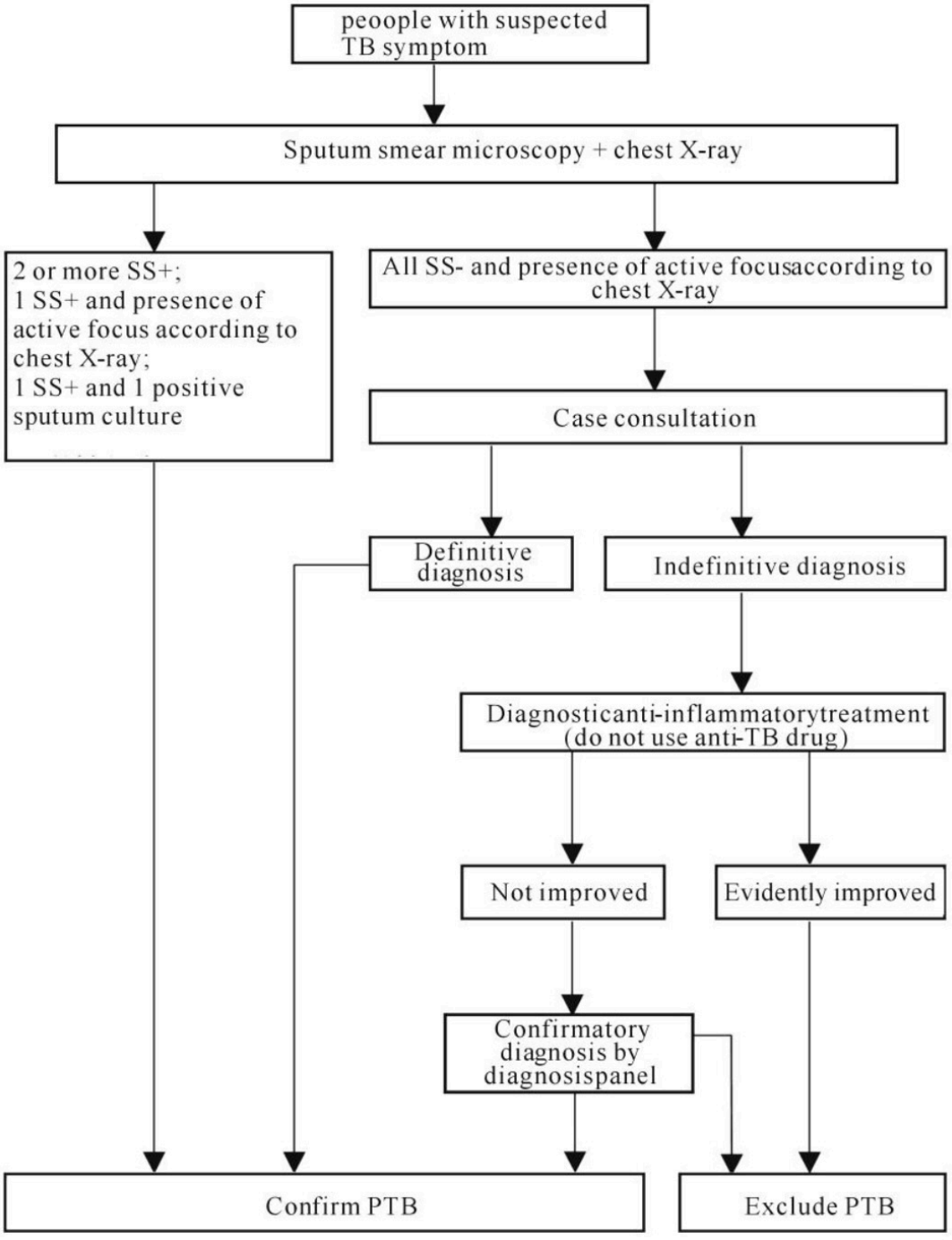

Table 4: Flowchart for the examination and diagnosis of pulmonary tuberculosis in patients aged ≥ fifteen years (Yongjie Hu, Duan and Li 2008, 36).

After testing all three samples, the designated hospital laboratory technician selects and sends two of the three samples to the municipal laboratories for drug-sensitivity testing (DST) to ascertain if the patient has a drug-resistant strain of the disease, as per the drug resistance surveillance (DRS) protocol. The patient commences standard antibiotic treatment based on a drug-susceptible infection at the point of diagnosis. That means that if drug resistance is found later on, their treatment regimen will have to be adjusted. And the sooner the better, as exposure to ineffective antibiotics may cause the already drug-resistant bacteria to undergo further mutations and develop resistance to even more treatment drugs.

DST has traditionally been carried out using solid media that takes one month to culture slow growing *mycobacterium tuberculosis*. Liquid media culturing has been more recently introduced as the preferred method as it yields results within two weeks. The more advanced technological requirements and skills training necessary to carry out this newer method made for slow uptake however, and designated hospitals in Shanghai were still setting up this capability when I was conducting this research. The GeneXpert MTB/RIF machine is the most recent development in rapid diagnostic testing for tuberculosis and can yield a result as well as determine drug resistance to rifampicin, an important first-line treatment drug, in two hours.[48] Despite this crucial increase in efficiency, I only saw one such machine in use and it was reserved for testing at the municipal level for research projects. This was due to the considerably higher running costs attached to its use for both the laboratory and the patient,[49] I was told, and they were notably absent in the designated hospitals I spent time in. With instances of drug-resistant tuberculosis (DR-TB) on the rise globally, DST is an essential aspect of human attempts to intervene in microbial survival. Scene Two will explore an ethnographic account of this human-microbe interaction within a BSL-3 laboratory space.

[48] The GeneXpert MTB (tuberculosis)/RIF (rifampicin) was developed in the 1990s and has been endorsed by the WHO since 2010. Its technology has remained largely the same. No other significant advances in diagnostics have since been made.

[49] There is much research that highlights the challenges of using the GeneXpert machine for diagnosis of a social disease of inequality most prevalent in less affluent settings, or unstable places (Street 2014). Salient barriers include cost of cartridges and the technical upkeep and maintenance of the machine itself (e.g., Ansumana et al. 2020; Harper and Khatri 2020).

Scene One: The Devil is in the Details of DOTS-work

The above lays out the broad strokes of DOTS-related work for laboratory technicians at the district and municipal levels.[50] We can glean more details of what is involved in the daily enactment of these tasks from the following scene at the annual year-end conference. Here, a municipal laboratory staff member is standing on stage at a podium with a microphone and introducing the agenda for the following day's meeting. The room is large and full, and the din of comments and reactions to the speaker's statements increases as she goes down the list of issues that will be covered in anticipation of the following year's work to come.

> The first thing is that things haven't changed. We need to adhere to all the standards for biosafety, smear and culture. Waste disposal methods all need to be correct. The indicator of 40% positive rate for smear tests is still the same. As is the 85% successful culture rate for positive smears. Those indicators haven't changed. The main thing you've been querying is why when some personnel check online, they find that their hospital falls short of our assessment indicators and the final assessment total. This is because you are looking at the rates for the district and we look at the ones for the country. When you submit your statistics, we also carefully match them up with the rest of the country's rates. We now find that many of the new cases you upload onto the electronic registration system register as much fewer on our national platform. Some hospitals are coming in as even a third less. This means that while there may be thirty new cases noted in your monthly report, we see perhaps fifty new ones on the national platform. Then, in that case, our denominator is bigger than yours and so your rate will go down.

This first order of business relates to metrics the laboratory technicians must achieve in order to be recognised as having conducted successful and quality-assured work of an appropriate standard. Technicians can only have performed work of a professional calibre if they carry out procedures that follow specific laboratory and safety protocols and that yield certain predetermined rates of results. These standards comprise part of the quality assurance system that "is a key step towards ensuring the accuracy and reliability of laboratory findings", as stated in this section's opening quote. Being able to see *mycobacterium tuberculosis* under the microscope four times out of ten, and culture it successfully more than eight times out of ten tries

[50] Laboratory technicians have further responsibilities such as testing for other diseases, routine blood work, and laboratory analysis for municipal, national and international projects.

has been predetermined as maintaining this standard. Failure to achieve these percentage targets leads to points being deducted, which leads to salaries being reduced. This knowledge is the cause of the mounting din as the speaker continues.

> The second issue is the sputum-smear testing quality pass rate. Here we're referring to the thickness of cell membranes and the stain colour being equal to or above 98%. We evaluate this in our monthly and quarterly EQA [Evaluation and Quality Assurance] examinations where we will draw up the film and then have a second team carry out a retest. Then Dr. Dong [董] here will send you a form, which includes the comparison rates and revaluation results. Again, here we encounter another big problem, which is the same one we talk about every year. You must describe the quality of the smear test on the form so that we can carry out an assessment at the end of the year. We still find that many people don't fill in this information if they see a good smear picture. So I have to stress again, and especially for the next EQA, that everyone must fully complete this entry on the form. Please include all the necessary information.

Another method of making quality assurance real is by recording it. Specifically, it needs to be inscribed in order to constitute having taken place. Only with this record, be it in paper form or a digital file, can it be believed that work was carried out. Indeed, without it, no evaluation of quality can take place as a laboratory technician's mere verbal word cannot be taken as the truth. Written down, however, this record of reality is further taken as being the objective truth; despite it having been inscribed by the same individual who carried out the testing and who, presumably, doesn't want to lose points nor salary. Record keeping and inscription are fundamental techniques in the conjuring of scientific realities (Latour and Woolgar 1986). The production and submission of these records in good time is another way of demonstrating capability.

> The next issue is completion of the laboratory registration items. The patient's smear picture needs to be expressed clearly and in accordance with the stated requirements. Cultured specimens must be delivered to the SCDC tuberculosis laboratory on time so that it can undergo the next analysis. The accompanying paperwork and reports must also be submitted in a timely manner. Some hospitals don't accomplish this on time and it makes completing our month's work very painful. We must then call and email non-stop to chase you up. So here is a reminder of the important points:

The monthly statement must be submitted before the tenth of each month. If it falls that the tenth is a holiday, then the statement must be submitted within a consecutive working day. We have now adjusted the requirements so that if you are late three times, we will deduct points. [The communal din rises, and some individuals voice their protests]. And the submission time will be according to the email date and time stamp. [Someone questions this new adjustment]

Is this so difficult? Just send an email, these are basic requirements, and our software makes things easier. [Readdressing the room] This is routine work; you just didn't do it properly last year. And now this year, I'll reemphasise the time limit is the tenth of each month or the next consecutive working day if the tenth falls on a holiday. A point will be deducted if the submission is late, and another point will be deducted if the form is not fully completed.

The rise in noise volume at this point was considerable. Technicians turned to each to other to shake their heads and comment on the new demands. The speaker continues down the list.

Next is the rate of smear contamination. It needs to be maintained at 2 to 5% for solid media culturing, and 1.3% for liquid media culturing. We've noticed that everyone thinks that this number should be kept low, the lower the better, but this is actually a misunderstanding. That's because the culturing rate is also a reaction: it indicates the quality of the culture, and if it is too low then it indicates that the processing time was too long and some of the tuberculosis bacteria were killed. Again, make sure to record these details comprehensively. The scoring criteria for the processes of patient registration, sample smear and culture are as follows:

If smear testing yields either a high false positive or high false negative: five points are deducted;
If culture contamination rate exceeds normal range: ten points are deducted. If it is lower than normal range: we'll talk about that tomorrow;
High quantification error: deduct one point for each instance;
Low potassium amount accumulated: one point deducted;
If you haven't started keeping the relevant records for indoor quality control by our mid-year assessment, we will have to start deducting points.

There are considerable checks and balances entailed in carrying out DOTS-related laboratory work. What is written up as being straight-forward testing and results gathering in the SOPs is actually a highly managed process that requires continuous maintenance and even reprimanding if standards stray. From staining to see the presence of rod-shaped microbes, to describing what was seen, to growing more of the infectious agent, to recording how they grew, to delivering them to another testing site, to inscribing that this work was done and done so on time – this work is taught and learned, and, in the process, habituated. Laboratory technicians come to embody the methods and standards of how to interact with microbes and, through their work, Shanghai gains what is considered a professionally implemented tuberculosis control system; one that is standardised, efficient and based on quality assured scientific rigour. The environments in which laboratory technicians (be)come to interact with microbes is invariably a part of this embodied learning; this process of habituation in knowledge making (Marchand 2010).

> All laboratories have received the outstanding hardware requirements and some laboratories have been renovated. This fulfils part of last year's work plan in relation to the three-year China Foreign Affairs project. This year we're going to focus on the use of liquid culturing in all laboratories. You must all have launched the liquid culturing method within the first half of the year, otherwise you will deducted two points. According to our statistics, there are already a lot of *danwei* who have started to use the new method but there is still a group of you who have not. There is no reason for this as theory and operational training off- and on-site have been all been carried out and the relevant supplies and reagents have all been distributed. So every hospital, no matter what, you must carry out what's been stipulated and launch within the first half of the year. We are aware that the transition is taxing for various reasons: the liquid culture technology is not very stable and contamination rate is either too high or too low and hard to stabilise; this should improve within one year. And then there are some *danwei* that have applied for the new machines and who say they'll launch liquid culturing after the machine arrives. So, calculate it yourselves. Will the machine arrive before June 30th? That's fine if so, but we recommend that you carry out the procedure by hand first if not. The principle, skills and method are all the same when done by hand or by machine. Just the image is rendered differently at the end. This won't affect your operating procedures later when you receive the machine.

Laboratory technicians work in spaces built to particular specifications, populated by complex machinery, facilitated by laboratory hardware like pipettes and microscopes,

and shared with substances such as liquid media and microbe-saturated sputum. They require specialised training to navigate these spaces and must adorn personal protective equipment when within this environment. At no stage do laboratory technicians come into direct contact with *mycobacterium tuberculosis*. There is a permanent barrier between it and them – materially, in the form of a mask or gloves, and conceptually, with the assumption that humans and microbes are different and that, within this environment at least, the human has the ability to control the microbe. Technology saturates these human-microbe interactions. Possessing and being able to wield such tools instils, at once, a sense of human control and mastery over the microbe, and accentuates the difference between the two as well as the distance that must be traversed in order to render *mycobacterium tuberculosis* seen. If this is the logic, and seeing is knowing (Prentice 2012; Good 1993; Foucault 1988), then it follows that more advanced technologies will allow humans to know more and thereby control better. However, they must firstly learn how to wield these increasingly advanced technologies to a professional standard in their attempts to keep up with *mycobacterium tuberculosis*.

> The last item is participation in training. Personnel must be trained and qualified after the induction. Training attendance must be greater than 95% and you are required to sign in for the sessions. There is a morning sign-in and another sign-in in the afternoon. If you really have conflicting work commitments, then you can put forward an application for exemption. Each missed training is a 5% reduction and deduction of 1 point.
>
> I want to reiterate that it's not easy for us to organise a training session. We spend a lot of energy doing so. From applying for the budget, to inviting lecturers, working out logistics as well as the accommodation and food. We hope you won't miss out on these useful and required opportunities.

This encounter at the year-end conference fills in a more detailed picture of how DOTS-related work is enacted by designated hospital staff and those at the municipal level. It also conveys the relationship between these actors. The municipal staff speaker is informing the district technicians of their tasks and responsibilities; a reminder that it is they, their municipal colleagues, who will evaluate how many points will be retained or lost when the time comes. This is an obviously hierarchical and monodirectional relationship where the din of the district personnel can be heard but also dismissed when there is disagreement about standardised demands. However,

this relationship is also contingent, with the municipal staff unable to carry out their tasks without the cooperation of the district personnel. They work as a production line in order to enact tuberculosis control; to identify the microbe for annihilation. They have, through repetition and over time, habituated how to interact in specific ways to see and know the rod-shaped life they find within specimen cups. Unlike patient management, as discussed later in Chapter Five, the work of laboratory technicians is not dependent upon the patient – just their sputum. Or, more specifically, upon the *mycobacteria tuberculosis* caught within their sputum, which they can extract to control and manipulate. Even though laboratory technicians become within an environment that strives to account and control for every variable, my interlocutors were nonetheless highly conscious of the indeterminacy of human-microbe relations in a sort of matter-of-fact way. The need for constant vigilance in order to be in control reminds, as well as placates, of what it is one is trying to keep at bay.

Scene Two: Close Encounters

'Gowning up' takes a while. I'm grateful for the informational video the laboratory technicians asked me to watch before entering this BSL-3 laboratory. Otherwise, I wouldn't have known where to start. First hair cover, then long-sleeved gown, then facemask, then hazmat suit, followed by shoe covers and, finally, the shoe protectors. The gloves go on last and it's two pairs; they must go over the sleeves of the hazmat suit. I'm in the anteroom with two other technicians and Dr. Rui is kindly helping me to figure out how the various pieces of personal protective equipment work, how they should be worn, and in what order. She helps to tie the strings of my gown and shows me how to pinch the nose of my N95 facemask to ensure that there are no spaces through which external air can enter.[51] I notice that I feel a little dizzy, and remember that BSL-3 laboratories maintain negative air pressure as a safety measure to ensure inward directional airflow and prohibit airborne microbes and particles from exiting the rooms through open doors, closed doors and cracks, or through the air vent. There are no windows in a BSL-3 laboratory. The air within these spaces is further filtered by HEPA filters to ensure that exhaust air from the laboratory is microbe-free before it is pumped outside.

[51] A N95 mask is an item of personal protective equipment that protects the wear from particles and liquid contaminants. The 'N' stands for 'Non-oil' for use in environments with no oil-based particulates. '95' indicates that it filters out 95% of contaminants ≥ 0.3 microns. HEPA filters filter out 99.7% of contaminants ≥ 0.3 microns. The *mycobacterium tuberculosis* bacillus is 0.2-0.5 microns in width, 2 to 4 microns in length, and travels in airborne droplets measuring 1 to 5 microns (e.g., Wurie et al. 2016).

I am in the SCDC tuberculosis municipal laboratories. This facility is the only one in the metropolis equipped with BSL-3 facilities, which means that all DST is carried out here. This task is one of the main functions of these tuberculosis laboratories. The other buildings within the SCDC compound are older in construction and more office based in their layout. Breezes blow in through chinks in doors and windows, and most office doors are left open for colleagues to walk in and out. In contrast, Building Two, which houses the municipal laboratories, is designed to CDC and WHO specificationsand built to keep things in – microbes especially and, to an extent, the humans who work within it.[52] Almost every door requires a keycard to enter, with keycards programmed to allow entry into certain areas and not others. Tuberculosis personnel may not enter the HIV laboratories, for example, and vice versa. Even within a department, the laboratories have controlled access zones that permit authorised personnel only. As per BSL-3 requirements, entry into and out of the laboratory space is separated and controlled by the anteroom, in which I am gowning up. It is a long enclosure connecting the corridor to the BSL-3 laboratory with a door at either end. It functions as an airlock: both doors must be closed in order for either one of them to open and only one can be open at any given time; a closed door will not release if the second one is not fully closed. This mechanism acts as an extra safety measure in case negative air pressure is lost in the main BSL-3 laboratory.

The seriousness of safety is felt as one moves through the steps of gowning up within this highly controlled environment. Each new piece of personal protective attire I put on becomes one more layer between me and the environment of sub-visible airborne dangers I am about to walk into. As if reading my thoughts, Dr. Rui begins to tell me that she is not afraid to work within this environment of risk every day. That the SCDC laboratories are well supplied with personnel protective equipment and that that makes the difference. Other laboratories around the country are not so well equipped and technicians have to depend on their immune systems and the biosafety cabinets to avoid infection. In previous years, gowns and standard medical facemasks were the only protection available and she herself carried out risky laboratory work using only these. I asked her was she afraid then. Dr. Rui answered yes, she was, but she isn't now.

"Ready?"

[52] Laboratory biosafety became a priority and was stepped up in China in 2004 according to WHO specifications. This was due to the infection of two CDC technicians in Beijing with SARS through working with improperly handled batch of the virus.

I nod. Dr. Rui opens the second door and we enter the preparation area.

All the testing equipment and racks containing test tubes of samples and solid culture media are first readied here. They are then placed into a double-sided window space before the laboratory technician enters the next room and retrieves them from that side. Similar to the anteroom, the window space is an airlock and only one window can be open at any time. Liquid culture media for DST is also stored here, although they are used less frequently as it's a more expensive process and it's the patient who foots the cost. We deposit the sputum samples, racks with test tubes of solid media, pipettes and disposable heads into the window space. Then we open the third door and enter the main work area.

The fan is louder in here and I'm starting to feel hot in my suit. The air is dry and I strain somewhat to breathe through my N95 mask. I am feeling the effects of the negative air pressure more intensely and I reach out and steady myself against the worktable. The room is sparse and consists of only metallic surfaces, huge machines for storing the cultured tests tubes, and a biosafety cabinet. There is no clutter in this room at all; nothing gets left in here. All the surfaces are clear, waiting to be used and then to be left clear again; sterilised and left bare. There is a large pump spray bottle, the kind you use for gardening it looks like, of sterilising alcohol of a high concentration that is used regularly to disinfect as the work is being done. The smell of alcohol saturates the air I'm trying to adjust to breathing; it smells and feels sharp as it goes in.

My peripheral vision is narrowed. I find it difficult to turn my head fully with my hazmat suit zipped up, and it's hard to hear what people are saying to me through their facemasks and above the noise of the fan. I try to concentrate and look to their eyes for clues of expression. Everyone knows exactly what their job is. This is not an environment in which to loiter or be lackadaisical. Everyone has their role, they perform it, and then they leave. I watch the technicians work efficiently in concert as a coordinated team. One is checking the racks of cultured test tubes prepared a month ago for growth. She works at speed and with just a quick scan of each rack, calls out the patient number and culture results for another technician to record on a sheet of paper. Some of the tubes are bright green with well dispersed growth in the form of balls indicating successful culturing and a low concentration of drug-resistant bacteria. Tubes with the medium changed to a darker aquamarine colour and dense growth indicate contamination, and these cultures will have to be redone. This entails asking the patient for new sputum samples and then another month of culturing, and significantly delaying any necessary adjustments to the patient's treatment regimen.

There are still other tubes with orange growth along the sides indicating further contamination. The technician recognises them all with a mere visual scan.

Another technician is recording the new arrival of cultured samples from multiple hospitals that morning. This is again done with a pen and paper, with each set of cultured samples accompanied by its own inventory of forms and multiple sheets of patient information. It's the technician's job to go through these tubes and documents and ensure that the information is matched on both. If so, then he wipes the hospital code markings off the top of the test tube cap and inscribes instead the SCDC laboratory's code. The technician is disgruntled as he doesn't like this work. It's overly complicated and fiddly, he says, complaining that the task is further convoluted by the fact that "the hospitals don't write the patient's name on the tubes anymore!". The first technician replies that some hospitals do and some don't.

"They all don't!", he exclaims. "And they all use different codes too so there is no consistency! That's why we have to give them our own codes when they arrive." The technician finishes his batch and is ready to leave. He suddenly realises that a new batch has arrived into the window hatch and he becomes further agitated saying that he wants to leave. The first technician, who seems to be the head of this morning's DST session, gives him permission to go. The noise of the fan, the effects of negative air pressure, the dryness of the air, the sharpness of metal and unrelenting scent of sterilisation in your nose and on your tongue persists through all of this. He left immediately.

I make my way to the biosafety cabinet where another technician is sitting and carrying out the DST. I see that the cultured ss+ samples, the solid media in test tubes, pipettes, disposable heads, and other materials are inside the cabinet. The cabinet has a filter that extracts and filters the air as the technician opens the ss+ container and carries out the skilled task of smearing each tube of solid media with a swab soaked in the sputum specimen of live bacteria. Uncapping the sample should only be done within a biosafety cabinet. The technician holds the test tube containing solid media in one hand. It is half filled along one side with the bright aqua-green substance rich in protein. It may also be saturated with a treatment drug, or it may not if it is a control tube. The swab is snaked along the length of the media to spread it as evenly as possible. The cap is then replaced and screwed back on using the thumb and first finger of the same hand that is holding the test tube. The tube is then replaced in the rack – each patient has their own rack – with marked positions for the control and for each drug tested. These completed trays will then be placed into another cabinet that is heated and kept warm to promote growth. *Mycobacterium*

tuberculosis is a slow-growing microbe and it will be one month before these test tubes will be checked again. I realise that I've been so focused on the technician's steady and methodical skill that I had forgotten about the discomforts I'd been so aware of. Seeing others seemingly unbothered by the abrasive conditions has helped me to adjust. This must be part of the habituation process.

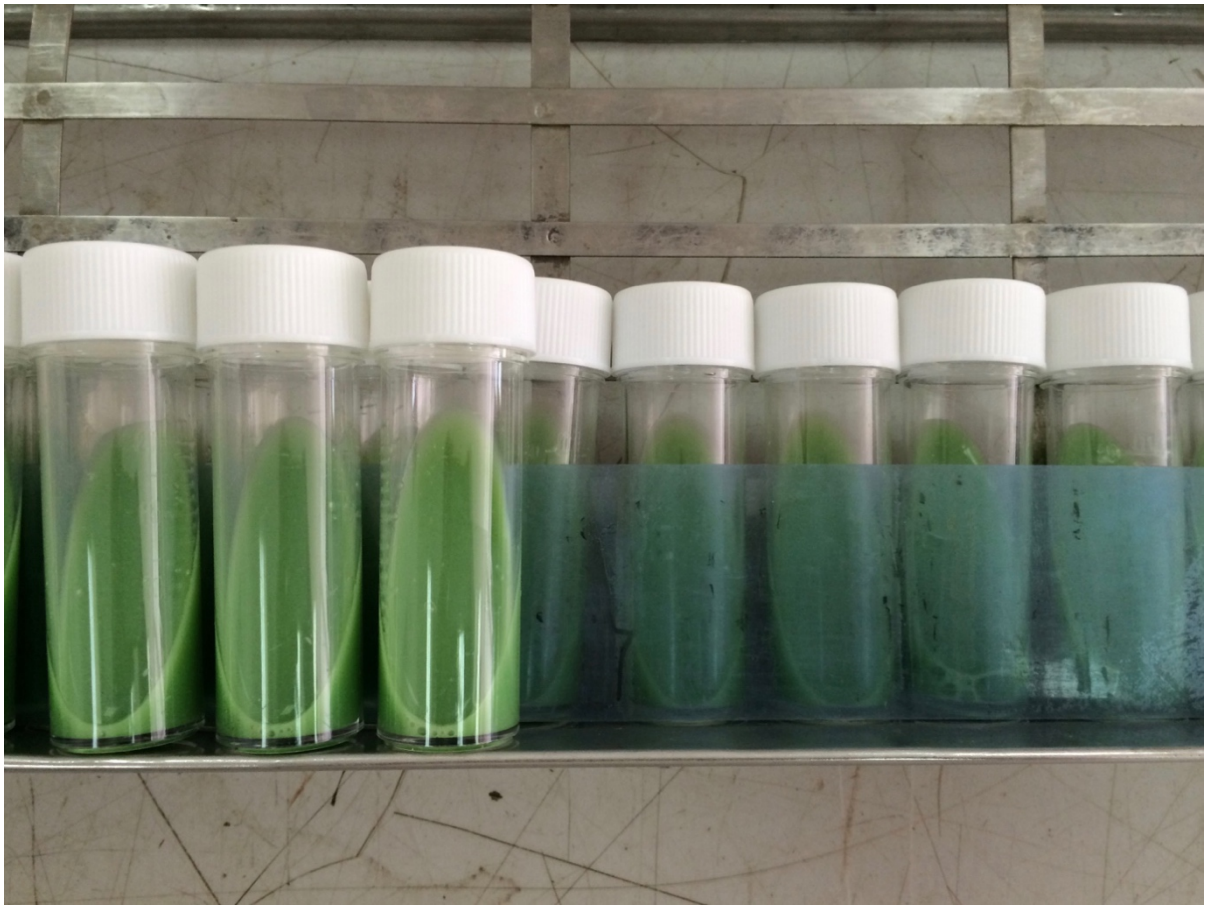

Figure 9: Tubes of solid media for DST (Source: author's image).

As I revisit my experience of being in a BSL-3 laboratory, I can still hear the fan. I remember gowning up and conversing with Dr. Rui, but I can vividly recall what at first sounded like the deafening whirr of the fan. It was so loud and in surround sound, despite my ears being tucked inside the hood of my hazmat suit. It was so loud that we had to speak with raised voices and it took me time to adjust to understanding others' speech as their voice had to travel through a thick N95 facemask and then through my hazmat hood to reach my ears. So I searched their eyes for clues. My hood zipped up to over my facemask and my field of vision narrowed to straight in front me. The many and constricting layers meant that I had to turn my body and neck

together to perceive what was beside me. My body's reaction to the sterile and filtered air was to take short breaths. I tried to make sense of why it smelt and tasted so sharp and metallic, and I noted how it felt as if the air was so dry that it sucked the moisture from you as you breathed it in. I reached to adjust my facemask in case it was leaking air. Feeling through two layers of latex gloves for slight openings along the edge of a stiff facemask mostly covered by my zipped hood felt ineffectual and blundering. I could only pat around my nose area and trust that the N95 was still in place and working properly. Writing this now, I realise that all of my five senses were distorted within this environment; bound and curtailed behind various layers that keep the outside out and me within. This is the overall sensation that I recall the most, and the experience of my brain and body's attempts to make sense of and adjust to it.

Our behaviour and movements were controlled, not least by the personal protective equipment but also by the construction of the physical space in which we were enclosed. The airlock mechanism managed access to the different areas; the air we breathed could only be of a certain quality; only particular items were permitted; only certain actions were allowed. Even the time one could spend in this space was limited as a facemask becomes ineffectual after a period of use. Everyone had a purpose for being in that space and then left immediately once they'd completed their task. Behaviour was efficient, directed, and had better conform to guidelines. These controls are in place for safety and to keep risk and danger at bay. And yet, at times, strict adherence and acceptance are not possible, and one has to leave.

Laboratory technicians bear witness to how their cultures become contaminated despite all the controls and precautions. They take pains to conduct DST within the sterile laboratory environment; to spray and disinfect; change pipette heads each time they test a new sample; swab and seal the solid media test tubes quickly so as to avoid airborne contamination; ensure that the prepared tubes are not interfered with for one month to, again, avoid contamination. And yet, there is contamination. Somehow, despite all the controls and precautions, microbes find their way into test tubes and if that is possible, then, presumably, microbes can find their way out of test tubes too – all of my interlocutors knew of someone or had a colleague who had developed tuberculosis. For these municipal laboratory technicians, contamination means that a patient has to wait at least another month before knowing if they are taking the correct medication or if they have a drug-resistant infection that is being treated incorrectly by their current drug regimen. Their colleagues in the designated hospitals will conduct further sputum-smear tests to *see* if the number of rod-shaped microbes is increasing, decreasing or the staying same to

determine if treatment is working. These staff are aware of the indeterminacy of sputum-smear testing, however. As explained by Dr. Lu,

> It's important to know the patient's condition so as to better manage their illness. A diagnosis doesn't just come from one lab test. It also needs a lot of clinical input. Having more information helps us technicians to interpret the lab results better and, in doing so, know more about the patient's condition. I'll give you an example: we might receive three samples from one patient and while two of them come back negative, one sample tests positive. Seeing these one-out-of-three results, the doctor might ask us to test more closely as, from conducting their clinical assessments, he or she suspects a high risk of TB infection. To do this, we take the positive sample and test it again. Testing in this way allows for a higher quality of comparison as both results are coming from a good sample whereas the samples that came back negative might be of poor quality. The results from these will be taken into consideration when determining the patient's course of treatment, especially if they are positive.
>
> Conversely, we technicians benefit from enquiring with the clinicians too. Another example: sometimes a patient may not be very productive and we can only find a few bacillus rods in their sputum. In such a situation, it is unclear whether or not we should report this incident as we need to detect a certain number of bacilli before we can determine a positive result. So we might ask the clinician whether or not they suspect TB. Again, the doctor has an idea from their clinical assessments and if they do suspect TB after considering all the exam results together, the patient might be asked for more sputum to confirm with another smear.

Although only laboratory determination can confirm diagnosis and DST, according to DOTS protocols, technicians are aware of the need to read the presence of the microbial in context. Their position in-between requires them to navigate the interstices between SOP theory and the real-life practices of handling bacteria. Despite copious controls and precautions, they find the interstices to be indeterminate terrain.

Scene Three: Gloves

> I've never been afraid. It's just the job. If you don't do it someone else will. It has to be done.
>
> (Dr. Zhou)

I'm interviewing Dr. Zhou (周) during her lunch break. We're seated on the suite of couches in a corner of the booming lobby of Building Two. Dr. Zhou has worked as a microbiologist since the early 1990s, previously in hospital laboratories before transferring here to the SCDC tuberculosis facilities. The lobby is bright with a high ceiling and an outer wall of windows. Two women in white coats speaking fast and loud enter the main door and a delivery man with a squeaky cart passes next to us; there's increased bustle in this space during lunchtime and all the sounds mix together and echo loudly. Dr. Zhou raises her voice so that I can hear her over the commotion.

Dr. Zhou: Perhaps it's because I've worked in laboratories for so long, and when conditions were very simple. Like what I'm using now, gloves and the other protective equipment, before there weren't any. There were no gloves. Working with tuberculosis then, you just had a facemask and a hat. Oh, and an apron [隔离衣; *geli yi*]. So you were in direct contact with the specimen.

TTS: Just using your hands?

Dr. Zhou: Yes, there was nothing else, just direct hand contact. There were only those few pieces of personal protective equipment. Sometimes you got the bacterium on your hands but there was nothing else.

TTS: Did it bother you?

Dr. Zhou: No, the people who taught me, they also carried out the work like that so I just did as they did. This was early on in my career, in the first three or four years, so around the mid-90s, and then gradually the conditions started to change. Things like gloves and the biosafety cabinet started to be used; before the work was simply carried out on a tabletop. And so gradually the hospitals improved, and we had gloves.

TTS: Is there a difference if you have or don't have gloves?

Dr. Zhou: Well, at the very least, with gloves I don't have to be in direct contact with the specimen.

TTS: What did it feel like then when you had the gloves?

Dr. Zhou: That I was protected. It just felt different…like you, yourself, are clean [干净; *ganjing*]. It wasn't that we felt that we were not clean before, but we just did what we'd been taught and didn't question it too much. Our understanding of protection wasn't as strong then. It wasn't like the standards set outside of the country; that we *must* wear a facemask, *must* wear an apron. No one insisted on it. If you wanted to wear one you did, if you didn't then no one would say anything to you either. It was like that when I began my career but even then, for me, if I could wear something, I did. Not for any particular reason, just that I saw others wearing them so I did too. I had a friend at the hospital who didn't like wearing the cap as it would ruin her hairstyle, especially if she had blow-dried it. So she would just wear the facemask. But not me, I wanted to wear all the pieces. I felt that I was better off wearing them rather than not. It wasn't because I was thinking of protection or anything like that. Just that I had seen others do so.

In terms of gloves, you couldn't see them. There were none. Only the surgical personnel had gloves. And if you did see someone with them on, especially if spotted by someone from surgery, you would say, 'Oh, look! Gloves!'. I remember there were none in 1991. And then in 1994, we had an old colleague transfer to us from another laboratory and he had the habit of wearing gloves. We all thought it was very strange. I even said, 'you can't *xian* [嫌; to be *suspicious* of] this and *xian* that doing this work!'. At first, I thought he *xian zhan* [嫌脏; resented dirtiness] but then, after watching him wear them so often, I started to wear them too.

Doing the work with gloves felt different from direct contact. We had trained without gloves in university, the touch/feeling [触感; *chugan*] is not the same. Taking blood from a patient, for example, feels different. It's less – direct contact is more sensitive. I got used to it. I forget now

what it felt like the first time I wore them…But you've seen our work: we have to go into the labs and come into contact with the specimens. It's very dangerous because they're live. If you asked me to do the same now, I'm not willing to handle them without gloves. Because now I have this habit. I'm used to it.

TTS: The older colleague who was the first to wear them consistently, did he give a reason for why he insisted on gloves?

Dr. Zhou: He felt it was clean. He never tried to convince us. Later, we just adopted the habit too. We observed him and thought about it, and decided it was good so then we all started to wear them. So, by 2003, we'd wear them for conducting microbiology but not necessarily for other tasks. Like for taking bloods, we definitely didn't wear them for that. But then, after 2003, our hospital admitted a TB-HIV co-infection patient. The HIV virus is transmitted through bodily fluids and so we wore gloves, even when taking bloods, because the level of danger had increased. After that, we wore gloves no matter what we were working on.

I remember that patients would complain if we wore gloves interacting with them though. They felt that we were disrespecting them, and patients would say, "do you have distain for me [嫌弃我; *xianqi wo*]?" and asked us why we were wearing them. It gradually changed. It was a process. At first, we didn't wear them if the patient complained. But then there were instances of medical staff being infected with HIV – there's still a chance you might prick yourself even if you're being careful. After that, we were permitted [允许; *yunxu*] to wear them all the time.

I do have one misgiving [疑虑; *yilu*] about wearing gloves though. In the hospitals, medical staff wear gloves when interacting with patients. But they interact with different patients every day and they might use the same pair of gloves with many of them. They could first interact with a patient who is feverish or have a cold, and then afterwards work with another patient and touch them with the same gloves. I find this uncomfortable [难受; *nanshou*], and I feel strongly about it. I feel that it's best to change gloves for every patient but perhaps the economic cost

is too high and we can't achieve that. It's ok not to change your gloves every time if you're handling specimens. But not doing so for patients, I feel very uncomfortable with this.

TTS: Like the swab you use to handle bacteria in the lab, you change that every time.

Dr. Zhou: Yes, and now they have the non-wash sanitiser and they'll [the hospital staff] use it before meeting the next patient but still use the same pair of gloves. I'm still uncomfortable with that! Because that medical person really does interact with so many patients and you don't know if they have sanitised before you come in. Maybe because I've worked in hospitals so I know, and this makes me feel very uncomfortable. I wash all my clothes and have a shower to wash everything off every time I go home after working in a hospital. You've no choice, you don't know. So you can only do what you can and practice hygiene when you go home.

We have different standpoints. From the medic's point of view, wearing gloves is protecting yourself, but from a patient's point of view, you are a vector of contagion and disease. I don't have a problem with this if you're handling specimens because the specimen doesn't run around the place. I can completely control it. But the patient, this one could have an infectious disease, and this one might have one too, and then your hand is touching this and maybe it comes in contact with the disease and then you're rubbing that, this is so hard to take if you think about it.

Before, in the labs, we would print a report after we completed the analysis. This physical report was also a vector of disease. Before we sent it out, we used to put it in the sterilising cabinet and then fumigate it with formalin. Now, we've solved this problem by using barcodes. The report doesn't have to physically pass between hands anymore. If you want the results, then you just scan the barcode and the information appears on the computer and you can print it yourself. In this way, the reports are clean. Whenever I used to see a paper report I'd feel...[Dr. Zhou makes a face and shakes within herself a little]. I would immediately wash my hands after touching it, or I would put it into some

kind of bag before reading it. Now it's all very clean because most places give you a barcode.

The humble glove, standard and pedestrian within medical settings nowadays, is a vital piece of infection control technology. Dr. Zhou explained what makes the glove so powerful for laboratory technicians: they allow them to handle live disease without having to be in direct contact with it. There is a barrier, a delineation, between one's person and the pathogenic microbes and this gives a feeling of cleanliness, and safety. There are obvious parallels to be drawn here with anthropologist Mary Douglas' work on the concept of 'dirt' – *zang* as Dr. Zhou would say – and the danger posed by matter being out of place (Douglas 1966). Douglas draws on Émile Durkheim's (1912) work on boundary maintenance to preserve the integrity of the sacred and profane. This feeling of repulsion, or *xian*, is so strong that Dr. Zhou made a face of disgust and shuddered involuntarily in her body at the thought of being touched by gloves that may have another person's infectious microbes on them. Aware that the hospital harbours all kinds of pathogens on its surfaces and circulating in the air, Dr. Zhou must wash all her clothes and shower when she gets home to feel she is clean and that the danger posed by the unseen, and therefore unknown, microbes is no longer. By the time she returns home, she has already spent all day in the hospital and if she'd been infected with any disease, it is likely that it had already happened. But she carries out this ritual, this boundary maintenance, this reassertion of order to feel safe and at ease again – as put by another interlocutor, you do this to comfort yourself (安慰自己; *anwei ziji*). But Dr. Zhou did not always feel this way.

Dr. Zhou developed the habit of wearing gloves and associating them with protection and cleanliness over time. She started off her training and career not at all concerned about coming into direct skin contact with *mycobacterium tuberculosis*. She was even surprised when she witnessed others using gloves and thought that they were being overly fussy. Her perspective was pragmatic: the danger of being infected by disease was part of the job and if she didn't do it, someone else would. It was a gradual process for health professionals, patients and institutions to accept, adopt and allow the use of gloves as part of standard protocol.[53] Everything from seeing them, putting them on, feeling for your task through them, and also for others

[53] Economic factors pose real challenges to the maintenance of this standard, even if and after it has been accepted, adopted and allowed. There just may not be enough gloves to allow health professionals to use a fresh pair for each new patient. The practice of medicine in unstable places (Street 2014) has a bearing on how humans and microbes regard and relate to each other.

to see you wearing them had to be trained, mimicked and repeated – that is, habituated – so as to be normalised. And it's not just Dr. Zhou: uptake of glove use was also slow when they were first introduced for surgery in the early twentieth-century U.S.

Medical historian Thomas Schlich (2015) writes that surgeons at the time were already experimenting with their own methods of infection control and that the slow uptake was due to surgeons not seeing the *need* for gloves. The more mainstream methods included boosting the patient's immune system before surgery so that the body would defend itself against infection. Another method was to ensure that the surgeon's hands were thoroughly disinfected, or not touching the patient with their hands at all and using longer-handled surgical instruments. Even the reception of antisepsis was mixed, eliciting some supporters but also some of the opinion that the focus on sterilisation distracted from the underlying need for hospital reform.[54] These latter physicians emphasised sanitation and thorough cleanliness over the use of sterilising chemicals for infection control. Those health professionals, like Dr. Zhou early on in her career, did not conceive of microbes as something you had to delineate yourself from. Rather, microbes were part of the surgical or laboratory environment and one did one's best to work amongst them in place of annihilating them. There was also more focus on the body's active ability to overcome microbes rather than its passive need to rely on environmental antisepsis. Indeed, in order for gloves to become a commonplace item within the medical toolkit, the ideas and practices bound up with the glove had to be taught and habituated, which was a gradual rather than an obvious process (see Lynteris 2018; and Lei 2010 for examples of medical technologies both introduced by Wu Liande).

Medical historian Sean Lei (2010) writes of how various technologies and techniques for curbing tuberculosis transmission in the early twentieth century took time and, particularly, rhetoric to cultivate. In contrast to Marxist claims of tuberculosis being a disease of modernity and the poor sanitation and living conditions that ensued with the effects of the Industrial Revolution, tuberculosis was pinned as being a disease of tradition in Republican China. Tradition was considered to be holding China back from advancing, and the locus of this stagnancy was the traditional family. The traditional Chinese family was based on communality – members living together in shared spaces, sharing articles of everyday living, and eating food from the same

[54] Sterilisation as a distractor from hospital reform reminds of the phenomenon of antibiotics distracting from research on bacteriophage treatment and the primacy of the social and economic, in place of predominantly the pharmacological, in medicine (e.g., Brives and Rémy 2021).

plates – and it was this aspect that was targeted in the new public health messaging. Instead of communality, the new campaign emphasised individuality (个人; *geren*) and broadcast the message that by attending to one's own cleanliness, one would become not only healthy but also a model citizen – a clean body able to form part of a modern state (Yi Hu 2013; Rogaski 2004). Affluent families were considered to be more traditional as well as more stagnant, with not having to work whilst basking in luxury. The sociality of tuberculosis in China was, rather than being a disease of modernity as was the case in Europe, a disease of tradition and lifestyle, which infected the rich-who-lounged in larger numbers.

The new public health campaign addressed three areas of traditional family lifestyle: family members were to sleep separately and not all together on a *kang;*[55] every individual should have their own cup and toothbrush and not share them with others; and a rotating Lazy Susan – originally called the Chinese Hygienic Table by its inventor, physician Wu Liande (伍连德) – was introduced for communal eating, upon which the various dishes could be laid out with a corresponding pair of chopsticks for communal use beside each one. These communal chopsticks were to be used for taking and placing some food from the dish into your own bowl but never to enter your mouth; one had one's own pair of chopsticks for placing food into the mouth. In his article, Lei focused on the historical, cultural and political context to situate the emergence of particular material technologies as methods of disease control. He further examined how the use of these technologies habituated certain technologies of the self (Foucault 1988) that cultivated specific subjectivities and understandings of the world. This chapter also seeks to ask, in the same spirit, what can attending to the use of everyday medical technologies tell us about the ways in which we understand the (microbial) world and ourselves within and in relation to it?

We return to Douglas and the notions of clean and *zang*, of purity and danger. The basis for Dr. Zhou's mental, emotional and physical perturbation at the mere thought of cross contamination is the need, habituated over her career, for microbes to remain 'over there'. She has become used to there being a separation between her and pathogens, and the maintenance of this boundary ensures safety and order. The world is defined and known, as the self is defined and known, because the boundary exists. We use technologies to maintain these boundaries and we (re)instate what is known through their maintenance. The porousness or even total absence of this boundary elicits the feeling of the weird and eerie (Fisher 2016), of danger (Douglas

[55] A kang (炕) is a heated platform used by families for general living, including sleeping.

1966) and even abjection (Kristeva 1982). The weirdness of something over there crossing the boundary, infiltrating if you will, may elicit horror at the thought that we might become with-them and they become with-us. Because with no longer any delineation between you and that which must be kept out, one may become that which is feared. *Xian zang*, *xian* microbes, *xianqi* patients: one may fear the danger posed by the microbial and those who have become with-the-microbial – that is, diseased – as these delineations are unstable. They may be porous or temporary, and if that's the case, one may be infiltrated and also become diseased (Tyler 2013). This is the danger posed by delineations: that they can at once ensure purity and constitute danger. A technology such as a glove, a tool, can be either something that protects you or something that may spread pestilence. It represents a threshold where things come together – the uncanny with the comforting – which is unstable and in flux. It is both alluring and terrifying, and can cause one to shudder at the mere thought.

We gain these insights from the experience of laboratory technicians working at the interstices and at the thresholds of human-microbe relations. Sociologist David Armstrong writes that Émile Durkheim and Mary Douglas both theorised the significance of the boundary at the thresholds of "major changes in public health". He gives the example of how the great nineteenth-century framework of sanitary science gave way to an interpersonal hygiene that identified and monitored a new 'social' space; at the same time, Durkheim's writings celebrated the primacy of the social. And, equally, just as Douglas called attention to the incipient dangers lurking within the spaces lying outside of and between the main categories of the extant classification system, public health was beginning to embark on the great crusade to promote an ecologically conscious hygiene that recognised the existence of danger everywhere (Armstrong 1993, 408).

We are at another threshold of major change. Recent research into the microbiome and the discovery that we humans are actually composed of more microbial genetic material than human has destabilised fundamental assumptions of who and what we are (see e.g., Rees, Bosch, and Douglas 2018; Helmreich 2015). It turns out that microbes are an integral part of the human and that we cannot exist without them – they have already infiltrated us. They are fundamental not antithetical to us, to our health, and to our ability to heal and recover. Moreover, while microbes intra-act with humans they also intra-act with each other, including during antibiosis,[56]

[56] An antagonistic interaction between two organisms that adversely affects one of the two. The use of an antibiotic is intended for this purpose.

as explored further in the next chapter. It may be worthwhile for public health efforts to consider what bearing this new knowledge has for infectious disease and its control.

CONCLUSION

Within the DOTS system, tuberculosis control is conceived of as the identification and annihilation of the infectious agent: *mycobacterium tuberculosis*. This highly technocratic approach to infectious disease management is made possible by the laboratory technicians who can *see* the microbe. They can do so due to their highly specialised technical skills and scientific training that privileges visualisation as a form of knowing. Being able to see the microbe means being able to measure it, and laboratory technicians are the only health professionals who are permitted to confirm diagnosis, treatment and cure according to DOTS. The determinations made by laboratory technicians therefore produce knowledge that is deemed scientific and certain, and the ability to demonstrate this highly specialised capability asserts China's presence on the global health stage no longer as "the sick man of Asia" but as an equal contender.

This chapter challenges this technocratic certainty, however, and has explored the *maodun* and indeterminacy of how and what we know about these human-microbe relations. Rather than fixed and definite, I have shown how producing and maintaining these standards demands considerable effort by laboratory technicians. These health professionals who are positioned at the interstices between policy and the real-life practices of handling bacteria are praised, scolded, monitored, incentivised and even punished in order for protocols and targets to be upheld. Laboratory technicians work in highly specialist spaces designed to control the microbe and every precaution is taken to reduce risk and contamination. And yet, they are acutely aware that contamination happens anyway.

Laboratory technicians hold the frontline to guard against infiltration. In order to maintain the border, they don layers of personal protective equipment, spray and sterilise religiously, work in abrasive environments that they leave as soon as they complete their task, or sometimes must exit before they can finish, and use technology to minimise the risk they are exposed to. Although they do this to control and contain the microbe, it is certain that the microbe equally exerts a control and constrain over the human.

Tools are used to delineate human from microbe – a hazmat suit, antibiotics, the glove, to name a few – to allay anxieties caused by the infiltration of the weird and eerie. These artefacts are ambivalent and laboratory technicians working at the interstices have a visceral appreciation of how they can both protect from or become a vector of disease transmission. How one comes to conceive of, relate to, and act towards microbes is shaped through human-microbe intra-action that is contingent. Rather than certain, they are habituated and indeterminate. And they can be multiple, as the next chapter will explore.

Chapter Three

The Microbe Multiple

What is tuberculosis? The answer is multiple.

This chapter examines the ways in which tuberculosis is understood by the health professionals who manage its control. Specifically, it will explore the ways in which *mycobacterium tuberculosis*, the microbial infectious agent responsible for the disease, is conceived of by these experts from their various viewpoints. These individuals are trained in the medical sciences and take for granted a technocratic approach to knowing and controlling tuberculosis that is based on a specific bacterium. However, the ways in which they speak about (discourse) and act toward (practice) the microbe are various and belie the conception of a singular subvisible entity. This chapter argues that the different ways in which health professionals attend to *mycobacterium tuberculosis* indicate a microbe multiple. Following the work of philosopher Annemarie Mol (2002), these multiple and coeval conceptions of the microbe hold (micro)ontological significance for medical and public health practice. Moreover, these multiple microontologies (Hird 2009) influence how the behaviours of bodies and patients are perceived. In answering the opening question: tuberculosis would seem to be multiple things, as *mycobacterium tuberculosis* is understood, talked about and acted upon in multiple ways.

Whereas the previous chapter focused on human-microbe relations in the laboratory setting, and between laboratory technicians and *mycobacterium tuberculosis*, this chapter expands considerations of the microbial to include health professionals from the municipal offices, district centres, and community health clinics. It also addresses the issue of drug resistance, it being the most pressing concern for contemporary tuberculosis control both nationally and globally. The description and sentiments of the health professionals in the following sections will demonstrate how drug-resistant tuberculosis (DR-TB) is regarded globally; how microbial behaviour is being investigated at the national level; and how health professionals cope (or do not cope) when the assumptions of policy and the demands of lived reality clash in the community setting.

MANAGING VARIANTS

The different microontologies understood by health professionals and made through their enactment of policy indicate different kinds of tuberculosis. As developed by Mol, these disparate, perhaps even conflicting concepts are coordinated to comprise an over-arching sense of the disease. These concepts may be informed by examinations and tests, the results of which are made commensurable even if they are out of step with each other. Results are either placed into a hierarchy of importance, or common measures are established to enable translation between them. This renders different variants of *mycobacterium tuberculosis*' microontology intransitive and able to co-exist alongside each other.

Juxtaposing these variants below further demonstrates the processes of distribution, as developed by Mol. Once separated out, differing microontologies of *mycobacterium tuberculosis* may be connected by *flow***,** by which the patient engages with the many variants by following an itinerary of, for example, paperwork, appointments and interactions. The variants may have a characteristic in common, a *central point*, that connects them. Another method is *layering*, by which variants can simultaneously be different and true because the patient hasn't arrived at that layer of illness yet. Finally, variants may be connected temporally through *conditions of possibility* that permit or do not permit them to be known in the now – that is to say, they may be the case in the future if not so in the present. Overall coherence is sustained even if variants are separated and link up again later through these points of connection.

As long as they are coordinated and distributed – global definitions at the municipal level given more importance and separated out from the struggles of everyday management at the community level – then there is no opportunity for friction to take place between variants. It is only when they are brought together that a clash may occur, with health professionals in the interstices having to think of ways to mitigate the fallout. The term 'tuberculosis', then, is used by health professionals when they want to talk to each other about the disease. "It bridges the boundaries between the sites over which the disease is distributed" (Mol 2002, 117).

Tuberculosis is a signifier that enables health professionals to speak with each other about a disease in singular and universalist terms despite their differing conceptions that render the subject multiple. The following sections will explore some of these microontological variants, as understood and enacted by health professionals from different parts of the control programme, and their implications.

Whereas the first section describes a static, 'passive and controllable disease', the second section discusses the same affliction as being active and 'unexpected'. Doing so demonstrates how the "manyfoldedness of objects does not imply their fragmentation" (Mol 2002, 84), but rather, they hang alongside each other through the processes of coordination and distribution. However, variants can clash, and the final section describes how health professionals try to make sense of and manage the friction, or *maodun*, that arises when incommensurable concepts of microontology meet and hit up against each other. Through examining these epistemologies in action, this chapter explores such questions as: how is tuberculosis understood? How are bodies and patients perceived in the process? What work do these understandings achieve? How do they sit alongside each other, and what happens when they clash? The experiences of health professionals positioned at the interstices reveal that degrees of friction are always present when there are multiple variants. It is a matter of how much you attend them, how much work is done to coordinate and distribute them so that they cohere, that determines whether there will be a clash.

WHOSE TUBERCULOSIS?

A Passive and Controllable Disease

Preparations are underway for March 24th – World TB Day.

The municipal office staff has been busy preparing leaflets, informational booklets, and paraphernalia like plastic fans with drawings and details about tuberculosis printed on them. There will be several funfair-like events held throughout the city with games and prizes to be won, and tuberculosis awareness-building facts interspersed in between. Talks will be held and bars of soap and towels given to those who sign up to listen. The department usually arranges a radio slot to broadcast the significance of World TB Day, symptoms to look out for, and what to do if tuberculosis is suspected. The radio mention is only two minutes long and aired during working hours, however, and health professionals told me that every year they almost miss the mention themselves! So this year, they're taking on television.

The make-up artist is at work when I arrive. Dr. Luo (罗) is getting some final touch-ups for the recorded interview he's giving that will be televised on a local Shanghainese channel next week on World TB Day. I've been invited to observe the

interview and sit quietly at the back out of the way. It's the first few weeks of fieldwork and I'm still finding my feet, learning about the dynamics of tuberculosis from these experts, and trying to process all the technical information I receive daily. They begin the interview and I listen intently to Dr. Luo's authoritative responses to the questions asked, stating facts about tuberculosis with certainty. His comments on drug-resistant tuberculosis prick my ears.

Dr. Luo: Other places have a law. If you have TB, then you must have it treated. You must, according to that law. If you're told to stay in hospital, you must stay in hospital. If you're told to take medications, then you must take the medications. I saw it myself in the U.S. It was an Asian patient, not Chinese, who was diagnosed with a latent infection. She wouldn't acknowledge that she had TB and wouldn't take her medications. They locked her up for two weeks and then asked her if she would take her medications. She said she would. Then she was released.

Interviewer: Why do we still have TB?

Dr. Luo: In the 1950s, drug treatment was so effective that we [the global health community] thought that we could eradicate TB. But, from a global perspective, after the 1990s, we realised that we were all too optimistic. We didn't respect TB enough. There wasn't enough financial investment and not enough manpower to carry out the necessary work. The second reason is that the floating population increased, including international immigrants. The third reason is drug resistance, as the drugs became ineffective. Fourth, coinfection with HIV became more prevalent and having HIV significantly affects the treatment outcomes of TB treatment. So then, in the 1990s, our TB epidemic returned and presented itself as a new situation.

Now we deal with drug-resistant (DR-TB) or multiple drug-resistant tuberculosis (MDR-TB) infections. So we have to use second-line drugs and the success rate is only around 50% to 60%. There's a big portion of the patients who don't recover. Compared to the eighty to 90% recovery rate for our standard TB patients, that's a big difference. About one-quarter of the MDR-TB patients will die.

Interviewer: How do you get MDR-TB?

Dr. Luo: This is down to patients who don't keep the treatment regimen. Because to treat TB you have to be very disciplined: you must keep a regular [规律; *guilu*] lifestyle rhythm, be devoted [虔诚; *qiancheng*] to that rhythm, maintain good and sufficient nutrition, and rise early. You must do this along with taking the four different drugs for six to eight months. So some patients don't do this and then they develop MDR-TB. At the beginning, that's what we discovered was happening. But if these patients, after they've developed MDR-TB, still don't treat it properly, then it becomes infectious and they give it to others. So then, when others contract TB, they directly contract MDR-TB. So these are the two main reasons for contracting MDR-TB.

We had thought before that if people follow their treatment that they will recover. But now, our research has discovered that a lot of our MDR-TB patients have directly contracted MDR-TB. We've found that in 80% of patients with recurrent TB, that their MDR-TB bacterium is not of the same genetic makeup as their original infection.

Interviewer: Is all TB infectious?

Dr. Luo: Only if the patient has live bacteria in their sputum. If not, then they're not contagious. About 50% of our pulmonary TB patients are infectious. And not everyone will become symptomatic. 90% of people who contract TB won't become symptomatic. Only 10% will become so. Within that 10%, only 5% will develop symptoms within the first 5 years. The other 5% will only develop symptoms if something in their life lowers their immune system, such as becoming older. So it's usually only ten to twenty years later that those patients will become symptomatic. So don't be too afraid because we can prevent TB and we can treat it.

In our experience, we've found that if patients don't receive family support, then they're more likely to not finish their treatment and not recover. A patient's mindset may become low after they've contracted TB. They're afraid that they won't recover and may be afraid of judgement from others. But if the family supports, helps and cares for them, the likelihood that the treatment will work is increased. Because if you have TB, its infectiousness disappears after two weeks of taking the

medications. So it doesn't matter if it's your family member or your work colleague supporting you, as long as you stick strictly to the treatment regimen, then the infectiousness of TB will disappear.

Again, 5.5 million people have been infected with TB [globally] but only about 10% will become symptomatic. So everyone don't panic because it's more likely you won't become symptomatic. Just make sure that you care for your normal everyday life and reinforce your immune system.

Interviewer: How do you get TB?

Dr. Luo: It is an airborne disease which means that you can contract it from someone if they sneeze and if there's mucus. You cannot contract it through touching hands or other forms of contact. So it's best to have good ventilation in the home. But, again, if you take the medication, two weeks is all you need, so everyone doesn't have to worry.

I listen to all that Dr. Luo says and make notes. I'm reassured to know that I am already aware of almost everything he's mentioned. His description of DR-TB and how it is produced, transmitted and proliferated is as it is written in medical journal articles and CDC and WHO websites. The global eradication of tuberculosis was on the cards with the introduction of antibiotic drug treatment. The non-compliance of patients, undisciplined and undevoted, caused the re-emergence of tuberculosis but this time in a drug-resistant form, frustrating the possibility of eradication. The complexities of HIV-TB coinfection further compounded the crisis. I am surprised to hear that two weeks of treatment renders infections non-transmissible and note it down; another new piece of technical knowledge for me.

"We can prevent TB and we can treat it". In Dr. Luo's interview, *mycobacterium tuberculosis* is a known thing. It is completely controllable, static and always the same. This knowledge pins down the microbe and conveys a sense of certainty, which Dr. Luo draws on repeatedly to reassure viewers that there is nothing to worry about. One needs to only always treat it in the same way and it will be eradicated from the planet. It only changes due to patient non-compliance, which induces drug resistance. However, once the bacterium becomes drug resistant, it again remains statically so and gets transmitted to others in this resistant form. Only further human inconsistency can compel it to become resistant to more drugs. Within this understanding of the microbe, *mycobacterium tuberculosis* is a passive entity subject to human action.

Therefore, humans need only to act consistently, with discipline and devotion, in order to control this bacterial affliction.

This microontology is communicated and officialised in textbooks and journal articles, and broadcast globally by expert institutions and individuals. It forms part of the bedrock upon which the global health policy enacted by countries is based. Dr. Luo's use of 'we' also aligns him with the national and global health experts and universalises his statements in certain and authoritative tones. His words are materialised in SCDC-stamped leaflets and paraphernalia, and publicised on radio and television. In terms of coordination, this microontology is the variant found at the top of the professional hierarchy. However, even in Dr. Luo's official broadcast, we can detect the reverberations of a clash. He mentions how a patient was 'locked up' for refusing to undergo prophylactic drug treatment. If there is nothing to worry about and drug treatment is simple and straightforward, then why would the patient demonstrate such irrationality and not wish to adhere to treatment? Moreover, involuntarily incarcerating a patient is a severe measure. Dr. Luo's mention of this case suggests that the disease is one of significant concern, despite his reassuring tones.

Perhaps involuntary incarceration is used as a method of public health control because, as per this variant of *mycobacterium tuberculosis*' microontology, patients' non-compliant behaviour is perceived as being the sole reason for harder-to-treat tuberculosis. It is notable that no other forms of 'human action' are mentioned in Dr. Luo's explanation of how microbial resistance is acquired. Moreover, it is communicated that this pathogen can only be cured with drugs. Patients' bodies must be disciplined, maintain strong immunity, and rise early. Patients' main responsibility is to take their drugs without interruption, otherwise they will incur resistance and also reverse sputum conversion, making the microbe infectious once more. The bacterium is but a passive pathogen whose fate is under the control of (ir)responsible humans. However, it is documented that the global reduction of tuberculosis infection rates was already widely observed with the improvement of sanitation conditions before the introduction of antibiotics, and that a steady increase in infection rates followed the discovery of pharmacological treatment (e.g., Dixon and Macdonald 2018). Moreover, the aforementioned 're-emergence' of tuberculosis due to patient non-compliance is partial and misleading as the disease had never disappeared from less affluent countries (Packard 1989).

Anthropology has been critical of discourse that blames the patient for their own illness (e.g., Kehr 2020; P.H. Mason et al. 2018; Harper 2010; Farmer 2000,

2001). This seems even more relevant for DR-TB patients who must undergo a long, challenging and costly treatment regimen for an illness renowned for being a disease of inequality and poverty. Cure is promised, but only *if* you are compliant. But what of this promise for DR-TB patients for whom the drugs don't work? They are required to consistently and devotedly take second-line treatments in order to control their bacterial infection, some with serious side effects such as hallucinations and hearing loss, and all without the promise of cure (Venkat 2021, 2018). Moreover, sputum conversion in two weeks is not a certainty (see footnote 25) and it is even more complicated for DR strains. As informed by Dr. Luo above, cure from one infection does not confer immunity to future (re)infections, including those of the drug-resistant variety. Cure from *mycobacterium tuberculosis*, here understood and dealt with as a static and passive microbe, is only promised to 'good' patients who take their drugs diligently. But what of cure, a consequence of the touted control, in the face of drug resistance and precarious socio-economic circumstances?

An Unexpected Agent

We are in Macau. It's late summer and the humidity is high. The streets are narrower and much quieter than those in Shanghai. I slowed down my metropolis-tempo stride on my way here this morning to absorb the sights of sunlight streaming through palm trees and between unrestored colonial facades, the smells of warm sub-tropical city life, and the sounds of Cantonese being exchanged by neighbours as I passed. Now, I am sitting in a cool and darkened meeting room in the Department of Tuberculosis in the Macau CDC with the hum of air-conditioning droning in the background. Dir. Mei (梅) runs the department and has invited tuberculosis laboratory heads from three neighbouring provinces to visit the facilities. Prior to taking up his current position in Macau, Dir. Mei was the director of the Department of Tuberculosis in the Shanghai CDC for over thirty years and was central to crafting the control programme there (see Interlude: Dir. Mei for more). Trained as a medical doctor and practised as a clinician, Dir. Mei further became a public health expert and a microbiologist. He embodies an interstice through which knowledge and practice come together spatially and temporally, and are diffracted through him and his wide-ranging professional and personal experience. And he's been kind enough to include me in this gathering of departmental experts and collegial exchange on the condition of tuberculosis control in contemporary China. My ears are pricked once more to hear the discussion on drug resistance, particularly because it seems to deviate from established global messaging.

Dir. Mei: There's an epidemiological issue I'd like to raise. I brought this up at the Lushan Conference in either 2007 or 2005. Because I was thinking about the assumption that once you've had tuberculosis, you won't be infected again because you've immunity. It was around that time that I was working with Fudan University's microbiology laboratory and we investigated active tuberculosis infections that were assumed to be due to endogenous onset; that is, infections contracted when one is younger and then when older, one's immunity lowers and then the infection surfaces. However, we found that this wasn't the case.

So, what are the benefits of this finding? Well, on the one hand, if it's true that the majority of infections are endogenous, then it means that the prevention and control strategy has problems. It means that the vast majority of your sources of infection haven't been found. If this is the case, and we refer to these as latent infections, then I'm not so worried because it means that we can carry out latent TB prevention, which means the active case-finding of these latent patients and giving them prophylactic treatment. We need to get the pathogenesis principle clear in order to design appropriate policy.

However, another finding came up when we investigated drug resistance. It is assumed that we have many patients who supposedly acquired resistance after they commenced treatment and usually due to non-adherence. But through our research and using gene-sequencing, we discovered that many patients' original strain were not the same as their current drug-resistant strain. They are not the same strain of tuberculosis. Which is to say that it's possible that at the time when they were first infected, it's possible that they contracted two different strains of bacteria. Another possibility is that they contracted a second strain of the bacteria during their treatment for the first strain. These findings have implications for our understanding of acquired drug resistance.

Dr. Chen (陈): I want to ask a layman's question: if the treatment is inadequate, could that have a bearing on genetic changes? Can those changes happen within the human body?

Dir. Mei: Yes, there are three ways to acquire drug resistance within the body. Non-standardised treatment prescription by doctors; non-standardised regimen adherence by patients; and poor-quality drugs. But although

> these three ways may lead to genetic change, they don't change the strain. We're assessing it in terms of the strain now and the two strains are not the same. So then it doesn't fall into the categories of poor doctor prescribing or poor patient compliance resulting in drug resistance. Many of our clinical staff believe that patients develop drug-resistant infections due to their poor regimen adherence but that's not the case. They actually have drug-resistant infections from the beginning. When we published this research, we got over three hundred hits in less than a week. The main reaction to this discovery is that it subverts [颠覆; *dianfu*] prevention and control work theory. These last few years, we've used this research to apply for national funding to investigate this phenomenon.

I try to absorb the implications of Dir. Mei's findings. They contradict what I have read in medical journals and on trusted health-related websites, as well as what many of my interlocutors have explained to me. It is true that the LTBI programme is newly established and that countries are still grappling with how to implement the active case-finding of a disease you cannot see nor confirm through testing.[57] Perhaps Dir. Mei and his colleagues were more aware of endogenous infections due to their familiarity with local microbiologies (Koch 2013b) as the majority of tuberculosis patients in China had, indeed, previously been the elderly. Now that was changing with the loosening of *hukou* restrictions and increased mobility throughout the country.

As discussed in Chapter One, the country's 'floating population' of migrant workers is now the major demographic for tuberculosis infection. They travel from the countryside to major cities like Shanghai for work and to send home remittance. These individuals work long hours, usually live in basic housing generally shared with others, and often eat convenience food rather than food with higher nutritional content to save money or because they don't have proper cooking facilities. Moreover, as their *hukou* is outside of Shanghai, they are not entitled to public healthcare and so often leave health issues unchecked. These are model conditions for contracting tuberculosis and for reinfection to take place, and the floating population have indeed been pinned as a major cause of the rise in DR-TB. However, contracting two strains at once had not previously been mentioned, nor the possibility of contracting two different strains at the same point or later during treatment. If this is

[57] There is no gold-standard test for confirming LTBI.

the case, then drug resistance is not solely a consequence of patient non-compliance. A patient may adhere to their regimen and still suffer from the effects of a disease resistant to the drugs they have been diligently taking. Their illness becomes a drug-resistant infection, but not due to their non-compliance.

More technical information. I try to process these findings and their implications for DOTS, a programme entirely premised on the necessity of directly observing patients swallowing their medications to ensure that they take their drugs. If Dir. Mei's findings are the case, and regimen adherence is not enough to ward off re- or concurrent infection as propounded by global and public health authorities around the world, then something seems amiss.

The microbe discussed by Dir. Mei and his colleagues seems to behave differently to the one in Dr. Luo's description. Rather than static and passive, *mycobacterium tuberculosis* is found to be active in how it mutates, infects and survives in the findings shared by Dir. Mei. Different strains of the disease may infect the same host; concurrent infection may take place at the same or separate points; the origin of resistance is not apparent; drug resistance may still be acquired despite regimen adherence. This variant of microontology does not lend itself to being static nor passive.

He mentions that he carried out these investigations with Fudan University microbiology laboratory, one of the highest-ranking universities in Shanghai and the country. In doing so, Dir. Mei aligns himself with Shanghai's cosmopolitan cutting-edge status. Moreover, he asserts that he attended important public health conferences and published the findings in a medical journal that garnered immediate attention and approval. These actions establish this variant of microontology as being high up on the national (if not global) and professional hierarchy. Again, indications of a clash are observable, with the work being described as subverting established global messaging.

Dir. Mei includes "non-standardised treatment prescription by doctors" and the use of "poor-quality drugs" as additional forms of 'human action' that can lead to the acquisition of resistance. The prescribing behaviour of health providers is not always mentioned in WHO write-ups, however. Quoting from their website,

> The two reasons why multidrug resistance continues to emerge and spread are mismanagement of TB treatment and person-to-person transmission. Most people with TB are cured by a strictly followed, 6-month drug regimen that is provided to patients with support and supervision. Inappropriate or incorrect use of antimicrobial drugs, or use of ineffective formulations of drugs (such as use of single drugs, poor quality medicines or bad storage conditions), and premature treatment interruption can cause drug resistance, which can then be transmitted, especially in crowded settings such as prisons and hospitals. (WHO 2018)

The write-up pins the bodies and behaviour of patients with the blame and responsibility for creating and spreading drug resistance through their non-compliant behaviour, as discussed above.[58] This understanding has meant efforts to mitigate the acquisition of antimicrobial resistance (AMR) have solely concentrated on human behavioural management, including deterring misbehaviour through punishment.

Although not stated in the above, presumably, the WHO also perceives health providers as another cause of drug resistance as it has promoted the practice of antibiotic stewardship (AMS) as a major method of curbing AMR through standardising their prescribing behaviour. Again from their website, the WHO describes AMS as:

> interventions designed to promote the optimal use of antibiotic agents, including drug choice, dosing, route, and duration of administration. To address antimicrobial resistance, all clinicians must become stewards of antimicrobials by prescribing them appropriately and educating their patients and colleagues on the proper use of this increasingly scarce medical resource.[59]

The approach also pins health providers with the blame and responsibility of fostering AMR through their inappropriate practice. Cast as stewards tasked with "the careful and responsible management of something entrusted to one's care" (WHO 2019, 1), they are made professionally accountable for ensuring the proper use of antibiotics with the view to reducing drug resistance. The implicit assumption is that, along with patients, health providers are the other party responsible if resistance rates do not reduce. However, the findings described by Dir. Mei point to another route of AMR and pathogenesis – to another kind of microontology.

Microbes themselves are active in acquiring what humans understand to be drug resistance. Microbiological research has found the process to be a fundamental aspect of bacterial microontology. Microbes are genetically promiscuous, exchanging

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[58] From the wording used, it is stated that tuberculosis is ordinarily cured in six months if patients adhere strictly to their regimen. Drug resistance is caused by "inappropriate or incorrect use of antimicrobial drugs", "use of ineffective formulations", and "premature treatment interruption", presumably on the part of the above-mentioned patients. It is these patients who then spread their drug-resistant strains to others in "crowded settings". The crowded settings specified are "prisons and hospitals", communicating that patients who do not adhere strictly to their regimens significantly populate these spaces.

[59] https://openwho.org/courses/AMR-competency

and incorporating whole sets of genetic material with ease and doing so constantly (Margulis and Sagan 2002). This is enabled by a process called horizontal gene transfer (HGT) that allows microbes to swap genes with other microbes within the same generation and across species. A second process called vertical gene transfer (VGT) enables genetic code to be passed on generationally to the microbe's species-specific progeny. Microbes engage socio-genetically with other microbes in response to each other and their environment. Thus, what humans understand as drug resistance is actually microbes being microbes with and through their contexts.

Further research has discovered the bacterial pangenome: a pool that contains all the genetic material of a particular species and from which bacteria can swap entire sets of genes with ease (Medini et al. 2005). In 2006, the resistome was introduced as a subset of the pangenome, comprised of all genes resistant to antibiotics from which the whole microbial community can draw from under selective pressure from antibiotics (Crofts, Gasparrini, and Dantas 2017; Perry, Westman, and Wright 2014). "While the resistome is undoubtedly ancient, there is no question that modern-day selective pressure is shaping its current form, degree of mobility, and allele frequency." (Crofts, Gasparrini, and Dantas 2017, 45). That is to say, the ways in which humans (over)use antibiotics is driving the acceleration and intensification of this process (Landecker 2016).

This means that far from being avoidable, drug resistance is inevitable as microbes ceaselessly coexist and intra-act with each other and with other elements within their environments. The resistome is communal and the more genetic material resistant to established antibiotics is in the pool, the higher the likelihood that an appropriate set of resistant genes may be drawn from it. This leads to more resistance that then becomes further pooled, and so on. Moreover, resistant genes are cumulative and move in clusters, so a bacterium may become resistant to an antibiotic having never previously encountered it. Antibiotics now saturate our environments; circulate throughout our food, water, soil and oceans; and profoundly influence the course of microbial evolution. The scale of antibiotic use has increased resistance globally and across species, even amongst those not directly targeted by antibiotics (Houndt and Ochman 2000).

Current research confirms that drug-resistant tuberculosis, including total drug resistance (TDR-TB), is bred through the mechanisms of both vertical and horizontal gene transfer. Moreover, research demonstrates that it may not only be patient non-compliance or poor health providers' prescribing behaviour that leads to drug resistance but perhaps the microontological tendency to socio-genetically relate,

despite almost all AMR control strategies being focused on managing compliance and prescribing behaviour. For example, health professionals in hospitals and care facilities have been found to be more likely to harbour drug-resistant bacteria from working in environments with high antibiotic use even if they themselves haven't been treated with those antibiotics (e.g., S.S. Huang, Datta, and Platt 2006).

Returning to the meeting in Macau, the variant of microontology described by Dir. Mei is different from the one broadcast over public health messaging by Dr. Luo. That was a microbe passive and controllable, as long as patients adhered to their treatment. Indeed, Dir. Mei points out that many Chinese clinical health providers take for granted that drug resistance is acquired due to patient non-compliance. In contrast, the variant Dir. Mei wishes to draw attention to indicates a microbe active and even creative (Margulis and Sagan 2002) in how it interrelates and intra-acts (Hird 2009; Barad 2007) within its ecology. This variant is able to confer drug resistance even if a patient does not stray from their treatment regimen. Different permutations of infection are possible: one can contract one or two (or more?) strains at once or become infected by two different strains either at the same time or later during treatment. These possibilities render drug resistance no longer solely a consequence of patient non-compliance. Due to their socio-genetic promiscuity and the mechanisms of horizontal and vertical gene transfer, patients who are diligent and dedicated to their treatment regimen may still contract drug-resistant infections. Dir. Mei reminds his colleagues that "tuberculosis is not just a simple natural science issue. It is also a social and economic problem". He states that controlling tuberculosis is ultimately an issue of managing immunity – immunity that is best reinforced by adequate nutritional intake and rest in conjunction with pharmacological treatment. This is best done by supporting patients' ability to ensure these socio-economic conditions of their recovery, not by blaming them.

Clashing at the Limits of Public Health

Doctor One: Honestly, I thought the work here was not going to be this hard.

Another meeting. This time, the municipal staff have organised a training session for district health personnel. The purpose of this gathering is for different district offices to exchange experiences and share insights on how they carry out their duties. Some districts have given a presentation on an aspect of their work or a specific patient case they thought would be of interest. Now we are into the Q&A session and district officers address each other directly with queries.

Doctor One continues: I have a question: I don't know if other districts have this issue, but I find that we meet lots of patients who treat us badly. We'll go to them with routine management and they just won't cooperate. We encounter so many patients who won't. We've met so many people who have moved here from the city. They are native Shanghainese. We have so many of them, they just absolutely don't cooperate. I find that these city people are particularly like this.

Doctor Two: Go to their home. The community doctor has to go to their home. To be honest, those patients that come from the city, the majority of them are very arrogant. Their attitude is: I'm Shanghainese, I'm originally from Xuhui district,[60] and now that I'm in Qingpu it's like it's an awful sentence.[61] So I say, then go back to Xuhui to get treatment, don't come looking for me. What right have you to act that way? The illness is yours, why are you treating me like this? You're the one that's ill, not me. If you get worse, if your lungs rot away, it's got nothing to do with me. I'm not ill, I don't have TB. I'm providing you with all this free treatment, it's for your benefit.

Doctor One: But if we speak like that, will it make things worse and create more animosity?

Doctor Two: It's exactly because it's these types of people that I would dare to get angry like this! If they were a reasonable person, I wouldn't get angry. I would speak reasonably with them. It's just this kind of person, if you let them bully you, you'll always be bullied by them.

Doctor One: We're having to beg them to take their treatment.

Doctor Two: Right, it becomes where we have to beg them but I'm not here to beg them. The illness is yours, if you don't take your drugs then who knows for how long you'll be ill. If your lung rots away what's it to me? My lung isn't rotting! But you have to be clear on why you're speaking in this way. If they were pleasant, I wouldn't be speaking like this to them. It's just these people, what right do they have to give us this attitude?

[60] Xuhui is district located in downtown Shanghai.
[61] Qingpu is a district located in the outer suburbs of Shanghai municipality.

Doctor One: And the main issue now is MDR-TB. We're finding many initial infections. Before the resistance was due to reinfection but now it's direct MDR infection. Especially amongst young people and *waidi* [外地人; outsider] patients.

Doctor Three: I have a patient who has refused treatment. He says why do I have to tolerate your monitoring my treatment? Can I not manage and monitor my own treatment? But he keeps stopping and starting his drugs.

Doctor Two: It's no use, we don't have the policy to do things with. They need to be locked up. You have to lock them up. They stop their medications every other day. They have an infectious disease and they still do it…You see it in the U.S., they have this law and policy.

There is a clash. As developed by Mol (2002), ontological variants can exist alongside each other without friction if they are coordinated and distributed. They may be connected by various processes at different points and still maintain overall conceptual coherence and functioning. The issue arises when variants encounter each other unmitigated and their incommensurability, or *maodun*, comes to the fore. The health professionals in the above meeting are expressing their felt helplessness at being caught in between policy in theory and patient management in practice.

Mycobacterium tuberculosis, particularly in its resistant forms, is the main cause of anxiety. Human action – that is, patient non-compliance and poor prescribing by health providers – is conceived of as the main cause of microbial mutation. For the project of tuberculosis control, the microbe becomes unmanageable if patients become uncontrollable. These individuals are not disciplined nor devoted to their treatment regimen. Instead, they are of the 'default' category and are responsible for creating drug-resistant infections, if they don't already have one. Most crucially, their intermittent or outright refusal to take their drugs means that they are likely spreading (DR-) tuberculosis – spreading *mycobacterium tuberculosis* – to others. For Dr. Luo, the microbe is a known thing, treatable and controllable, and no cause of panic. Dir. Mei was focused on the microbe's unexpected versatility in resisting and infecting. However, for these district staff, the microbe is a menace; waiting in the wings to escape, infect and rot patients' lungs whilst being almost impervious to the existing limited arsenal of antibiotics. Exacerbated by patients' evasion of and defiance

against being monitored and controlled, these health professionals at-a-loss expressed the need for involuntary incarceration of non-compliant patients as a final resort.

"The US already have it", is what I would frequently hear. The individual would invariably be referring to what they considered is the pressing need for government to pass legislation that allows public health professionals in China to enforce control over the physical movement of non-compliant patients. Indeed, U.S. public health law has,

> historically constrained the rights of individuals and businesses to protect community interests. Whether through the use of reporting requirements affecting privacy, mandatory screening affect autonomy, environmental standards affecting private property, industrial regulation affecting economic freedom, or isolation and quarantine affecting liberty, public health has not shied away from controlling individuals and business for the aggregate good. (Gostin and Wiley 2016, 11)

In the Shanghainese case, health professionals are specifically calling for the use of isolation as opposed to quarantine as a public health measure. Isolation is the separation of a patient known to have an infectious disease from other people known to be healthy. Quarantine is the separation of a patient who has been exposed to an infectious disease but who is asymptomatic and it is not yet known whether the individual has contracted the disease or not. These two interventions, and the methods used to enact and enforce them, were carefully distinguished during the SARS global health crisis (Jacobs 2007).

Involuntary incarceration of TB patients was enforced in the 90s in New York (Harper 2015; Draus 2004). A significant rise in incidents of tuberculosis and, importantly, MDR-TB resulted in a revision of the tuberculosis control programme to include forcible detention or isolation to comprise part of the public health toolbox. A secure hospital wing in the East River area was repurposed and patients were held there and treated until they were determined 'cured' or 'expired' (Draus 2004, 258). This method of control is predicated on non-compliance being considered akin to repeated criminal activity. It focuses on individuals whose behaviour needs to be forcibly controlled and the individual removed or isolated from society in order for the (public health) problem to cease. As argued by Draus, this rationale assumes all patients' motivations to be the same and fails to address the wider underlying social conditions that result in the persistence and proliferation of tuberculosis, as have been widely documented (e.g., P.H. Mason et al. 2018; Koch 2015; Draus 2004; Farmer 2001)

This debate is an ongoing and significant one. In 2014, the International Union for Tuberculosis and Lung Disease published results from a survey carried out with its members assessing *Attitudes Towards Involuntary Incarceration for Tuberculosis* (Denholm et al. 2014). From 194 respondents, 33 (17%) stated that involuntary incarceration was unacceptable on any grounds. Overwhelmingly, 157 (81%) of respondents advocated for this to be used as a public health measure to prevent transmission of the disease to people close to the patient or to the general community. Other reasons to support incarceration included: to ensure adequate individual treatment (67/161; 42%); prevent the emergence of drug resistance (97/161; 60%); or as part of efforts to reduce TB incidence (53/161; 33%). These findings indicate the uncomfortable tension "between individual rights to liberty and freedom of movement and the protection of community health" (Ibid., 159). That is, how human rights law and public health law come together, or confound each other, such as in the case of involuntary incarceration of non-compliant tuberculosis patients. The Kenyan public health system explored this tension when it enacted its Public Health Act and involuntarily incarcerated two drug-susceptible tuberculosis patients who defaulted on treatment in a local prison (Muigano 2016). The Kenyan High Court subsequently ruled the practice of incarcerating tuberculosis patients to be illegal and unconstitutional, and ordered an immediate halt to the practice. Indeed, the WHO guidelines on this matter state that incarceration or detention of a patient can only be carried out if it is absolutely necessary but cannot be used as a form of punishment.

Notably, with the Chinese health workers, the issue of involuntary incarceration was not discussed in terms of human rights but, rather, in terms of possibility and practicality. Whereas some health professionals stated unequivocally that they felt they had tried everything and that incarceration is the only measure left, others were more measured in their evaluations. They were aware of this happening in the U.S. but the situation in China is different.

> Our country doesn't have the ability to isolate these kinds of [drug-resistant] people. There are too many patients! Even consider, for example, that hospital beds for tuberculosis patients in Shanghai have to be pre-booked. Right? There are not enough beds and there is no way to isolate them. So this has created China's tuberculosis epidemic, because we there are some aspects over which we don't have control. There's no way – we have too many patients. (Dr. Feng)

Other experienced hands insisted that it cannot be forgotten that tuberculosis is a social disease and one of inequality and poverty. It is non-discriminatory in that it is airborne and so anyone can contract it, but only those nutritionally low and of poorer health will become symptomatic and require treatment. Dr. Zhou gives his opinion on the issue based on what his patients with non-local *hukou* have shared with him:

> They said, we are so grateful to receive good quality and free medications from the State, but we cannot stay here because we cannot live. If it's a choice between basic needs survival and staying at home to convalesce, how do you even think about the second option? You have to try not to starve first.
>
> If we cannot provide the right kind of treatment and supports for the types of patients tuberculosis ravages, then maybe incarceration will be necessary in the end. But firstly, these patients need for their jobs and place of abode to be secure while they are convalescing. This needs to be regulated and perhaps these are the laws that should be considered first. Otherwise, the already poor become poorer and tuberculosis will continue to proliferate. If patients can receive an allowance and have their jobs kept for them until they are non-contagious and fit enough to work, then maybe even a XDR-TB patient could keep living, and living well, with their infection because they are healthy nutrition-wise. But you need money to be healthy. This needs to be addressed because we will see more and more of these kinds of situations in years to come.

Dr. Zhou agrees that new legislation ought to be passed, but that which supports patients' ability to live, and to live well, whilst recovering from tuberculosis in place of criminalising their inability to do so.

These health professionals mitigate the fallout when there is a clash. In endeavouring to enact DOTS, they must navigate and negotiate local microbiologies (Koch 2011) within the socio-cultural and economic context of Shanghai. The microontology of tuberculosis from this position is understood as one of a risky and dangerous disease too complicated to control. Many of my interlocutors expressed their awareness of some of these complications. They stated that protocol must be carried out and to not do so is unacceptable. However, some also spoke with compassion for those patients whose socio-economic difficulties confounded their ability to adhere to the demands of the control programme. All condemned other kinds of uncooperative and even abusive patients, pronouncing them as bad (坏; *huai*) for not adhering to their regimen and not caring if they spread the disease to others,[62] as per polarising official discourse that dichotomises 'good' compliant patients and 'bad' non-compliant patients. However, these health professionals expressed these sentiments, with considerable fervour at times as observed during the meeting, due to the frustration and helplessness they experience in trying to make these complexities cohere. Like medical anthropologist Justin Dixon and clinical researcher Michèle Tameris, I interpret their exasperated statements with ambivalence.

> We argue that patient blaming and scolding does not simply evidence 'a lack of care' but rather nurses having to tread a fine and at times impossible line between compassion and assertiveness, individual and public good, all against the backdrop of a fundamental dissonance between the discursive framing of healthcare relations (premised upon patient rights and responsibilities) and the material circumstances in which nurses must actually deliver care. (Dixon and Tameris 2018, 258)

[62] Discussed further in Chapter Four.

For these health professionals, the microontology of tuberculosis is, at once, a bacterium that can be killed by simply adhering to drug treatment, and a microbe that capitalises on the complex conditions of possibility that fundamentally affect patients' ability (or want) to complete treatment. How these dynamics confer drug resistance adds further complexity and anxiety. Finally, unable to achieve protocol due to the multifaceted nature of infectious disease (of inequality) control, health professionals call out for involuntary incarceration as a final resort, but with ambivalence. This is an impractical solution to an intractable problem at the limits of public health control.

CONCLUSION

DOTS is designed for the technocratic management of tuberculosis – a singularly defined disease with a predictable and controllable microontology. This chapter has explored how tuberculosis is instead multiple, as health professionals at the interstices speak about and act towards *mycobacterium tuberculosis* in multiple ways. Rather than a universal object, the health professionals above have referred to different kinds of tuberculosis. Drawing on the work of Annemarie Mol (2002), I take these multiple conceptualisations of the disease to be variants.

Both variants of microontology that are gleaned from Dr. Luo and Dir. Mei are coordinated to be high up on the professional public health hierarchy. The microontology explained by Dr. Luo is one in accordance with established global health discourse on tuberculosis and how drug resistance is acquired. Performatively and symbolically, Dr. Luo is an official of the SCDC and represents national and municipal level expertise for the televised interview, which is the point of the broadcast. The microontological variant discussed by Dir. Mei is one specific to Chinese, Shanghai-based research carried out at the municipal level. However, although they expound different microontologies for how *mycobacterium tuberculosis* confers resistance, these variants do not clash and can both be true alongside each other.

Drawing from Mol (2002), the chapter demonstrates how these variants are coordinated and distributed to comprise an over-arching sense of the disease. Both variants have a *central point* in common and address the issue of drug resistance, the most pressing issue concerning tuberculosis control in China and globally. Not all patients have a DR infection, so developing DR-TB from concurrent infection from two strains can be interpreted as *another layer of illness*. There is a *flow* in moving from drug-susceptible to drug-resistant infection, the result of either non-adherence to

one's regimen or contracting a second DR strain. Finally, the development of metagenomic methods has presented the *conditions of possibility* to sequence whole genomes of microbial pathogens without culturing. This enables acceptance of how previous explanations of AMR may be true but not complete, perhaps even rendering these different variants complementary.

These mechanisms are not in place for the district and community health professionals in the final meeting. For them, tuberculosis is predominantly a set of transmissible symptoms that they are tasked with controlling by ensuring that patients adhere to treatment. This approach is as per protocol based on the standardised understanding of *mycobacterium tuberculosis* as passive and static. However, health professionals must mitigate the friction that results from this standardised concept of microontology clashing against one of *Mycobacterium Tuberculosis* the Menace, as embodied by patients who do not cooperate. In this encounter – in this instance of *maodun* – there is no coordination through hierarchy or a central point. The patients do not respect the authority of health professionals and they do not have the same concerns regarding transmission. Nor are the processes of distribution at work, with everything at a stalemate due to the clash. These circumstances compel some health professionals to call for desperate last-ditch solutions such as involuntary incarceration although they just as quickly describe it as being impractical for a country with a high disease burden like China. Their ambivalence is indicative of the helplessness they experience at the limits of public health.

Tuberculosis holds multiple meanings as the microontology of *mycobacterium tuberculosis* is understood differently by health professionals occupying different positions in the control programme. Their understandings are further reinforced by their enactment of these epistemologies in action. Concomitantly, these understandings can also be modified, adjusted or even subverted by health professionals' actions. Tuberculosis is the common terminology, the central point, used by health professionals to communicate with each other, even if they speak about different conceptions of the disease. How bodies and patients are perceived changes according to the microontology understood. This may have implications for the assignment of blame on patients and health professionals vis-à-vis the acquisition of drug resistance. The next chapter turns to the surveillance of *mycobacterium tuberculosis* through the numerical monitoring of patient behaviour.

Interlude: Dr. Pan

Grab the Opportunities to Learn!

Dr. Pan (潘) was a warm, chatty and pragmatic laboratory technician who began her career in tuberculosis in the 1990s. In her time, she'd witnessed significant change both in China's laboratory and microbiology standards and in work attitudes. She recalled contracting tuberculosis early on in her career, as was commonplace for most technicians until recently with better PPE and environmental protections. During our interview, Dr. Pan spoke of her illness, the way she coped with it, and commented on the younger generation's different attitude towards work and responsibility.

It was shortly after giving birth that Dr. Pan contracted tuberculosis. She was back to work after four months of leave, attending tutorial classes (补习班; *buxiban*) at the same time, and had just started the night shifts at the laboratory.

> I didn't actually have any symptoms. Just once I saw strands of blood when I coughed coming off duty. At first, I thought my gums were bleeding. I spat a mouthful of saliva but I didn't see blood. Then I felt nervous so I went to get an x-ray. My first thought and instant dread was that it could be tuberculosis. From the x-ray, they found infection in the upper section of both my lungs. But I tested negative in sputum smears and tuberculin skin tests and they couldn't culture any bacteria. They couldn't find tuberculosis microbiologically, they could only see it in the lungs and even then, it wasn't so clear but it resembled tuberculosis. They weren't certain at the time and so started me on anti-inflammatories for two weeks. If there was no reduction in inflammation after two weeks then they would proceed with tuberculosis treatment. At the time the doctor said it was a light infection and I debated whether to take the TB antibiotics. I tossed it up and finally, because there is a high concentration of the bacterium in our hospital, thought what the heck and took the medicine.
>
> I took three antibiotics: isoniazid, rifampicin and ethambutol for six months with checks and scans every month. I was off on sick leave all that time and unable to work. There wasn't any work-related support for professional hazards at that time. I had a light infection and caught it early so the symptoms weren't heavy. I also didn't think it was a big deal because all our colleagues before us, they all had it. The protection was so poor then, we just had a gauze mask. We sat the table here to do our work, there were no sterilising cabinets, and the gauze

mask didn't offer much protection. So the generation before us have all had TB.

As Dr. Pan recounted her story to me, I was struck by how she'd taken her illness and recovery in her stride. She had not seemed anxious to take the antibiotic treatment even after finding blood strands in her tissue! As she told me more, I came to realise Dr. Pan's pragmatic character, as exemplified by her exchange with her university professor:

> At the time, I remember our teacher spoke to us individually. He asked us what kind of *danwei* would I like to work in. I said that I want the one that's closest to my home! [she laughed].
>
> So it wasn't a choice to work in tuberculosis, they decided for us, we didn't get to choose. My professor stationed me at the local anti-tuberculosis station [结防所; *jiefang suo*] and I went there with two of my university friends. Things were very simple at that time, we didn't have a lot of big ideas [想法; *xiangfa*]. We didn't feel anything about it, we didn't understand anything! We just went wherever they told us to go. We couldn't compare with young people today.

In recalling how she herself had started off as a fresh graduate, Dr. Pan's comments turned to the difference in how young people approached learning and working in today's Shanghai. She described the shift in attitude from one based on a collective sensibility to one more conscious of oneself in relation to others. Dr. Pan explained how this latter attitude is highly aware of and clearly delineates between 'mine' and 'others' in terms of work and responsibility that runs counter to the more communal and proactive spirit that she herself had matured with.

> Back then, our teachers would tell us: young people should do more work! Do as much as you can! Grab the opportunities! [枪的来干活; *qiang de lai ganhuo*]. If you have the chance to work you should go and grab every opportunity to learn. Do everything! So we did everything. If we saw anything that had to be done, we'd do it. If the floor needed to be mopped, we did it. There wasn't such a strict division of who does what. Young people today are not proactive [主动: *zhudong*] like that. They'll do it if they think it's their responsibility. If they think it's not, they won't participate [参与: *canyu*] in it.
>
> During our education, we were reminded to do as much as we could, to respect older colleagues because they have much more experience, and to

learn from them. It's a form of respect to look to those who came before you because they have more experience than you. Young people today lack this respect. Compared to them, we were all very *zhudong*. We were all like one generation after the other, until this last generation. Sometimes we [her and her colleagues] see their attitude and it’s extremely hard to tolerate [很看不过眼; *hen kanbuguoyan*). It could be their education coupled with the effects of the one-child policy. They’re used to being more self-centred [自我; *ziwo*).

Chapter Four

The Numbers: Ledgering Control

Spending money is a complicated matter.
Dr. Ruan

Public health surveillance is often described as being the cornerstone of public health work. As defined by the WHO, it is the "…continuous, systematic collection, analysis and interpretation of health-related data needed for the planning, implementation, and evaluation of public health practice" (WHO 2020). These health-related data are predominantly in the form of numbers and made meaningful through their transformation into statistics. These statistics are read in relation to the specific standards set by experts and authorities based on particular understandings of health-related phenomena. They not only steer the direction of public health programmes but also fundamentally influence their design. Moreover, the picture(s) they paint conjure particular (but partial) versions of reality that construct epidemiological imaginaries (Reubi 2020) of health-related situations. Public health professionals spend the bulk of their time and efforts engaged in the collection of these numbers and compilation of statistics for interpretation; that is, in the technocratic management and human and non-human co-production of knowledge.

This chapter examines this cornerstone in public health practice through the lens of finance. A peculiar feature of the DOTS system in Shanghai is that 'free treatment' for tuberculosis constitutes reimbursing patients for their treatment-related expenditure after treatment completion when they are pronounced cured. At the time of research, the STP was the only system in China that operated through this incentive-based model, with all other provinces directly handing out antibiotic medication free of charge.[63] The reimbursement policy does not cover the full

[63] Anti-tuberculosis treatment outside of Shanghai is described as being less complicated by my interlocutors. Multiple antibiotics are contained within one pill in standardised quantities and combinations, referred to as *banshiyao* (版式药). They are given out for free as part of standard treatment protocol. The therapeutic preference in Shanghai is to prescribe the different antibiotic drugs separately. This enables clinical doctors to adjust drug combinations and potency if drug resistance is

treatment amount as only certain examinations and drugs are included and there are often many other ineligible clinical costs incurred.[64,65] Timely compliance with the treatment regimen is further necessary to secure reimbursement as examinations and prescriptions must be performed and picked-up at specific intervals. These tasks represent set indicators that determine what is tuberculosis control and whether it has been carried out. My interlocutors explained that this approach for managing 'free treatment' is customised to the particular context of Shanghai. Being the most populous city in China, the metropolis is the stomping ground of over 24 million inhabitants who are free to move around and allow themselves to be found or disappear.[66] Binding treatment completion with financial reimbursement is rationalised as incentivising patients to comply with and, crucially, to finish their treatment. It also invests health professionals with some sway as they can refuse to reimburse a patient who fails to adhere to their regimen. New patients sign a contract with their community health doctor agreeing to this stipulation at their first-contact meeting. Many health professionals regarded the *guanli* (管理) or management of patients as being akin to managing their reimbursement. I was told that without this incentive, patients would become difficult to manage (变成不好管理; *biancheng buhao guanli)*.

The surveillance of patients directly maps onto their reimbursement records. Unlike the sole reporting of epidemiological statistics, these financial artefacts afford understanding of the individual and not only of the aggregate. They document whether epidemiological targets have been hit and details of the wider socio-economic and medical status of the patient. Hospital receipts must be submitted in order to apply for reimbursement. Along with the eligible timely drug prescriptions and examinations, these receipts also list inpatient expenses; additional outpatient tests and scans insisted upon by the attending physician; co-morbidities that may result in other medications being prescribed and purchased; financial state support for locals, and the absence of the same for non-Shanghainese; the age and income of the local recipient gleaned from how much financial support they receive, amongst other details. These financial details matter for patients suffering from a disease of inequality, with their illness and recovery being inextricably linked to their socio-

found through DST or later on during treatment. These drugs are also of better quality and more expensive.

[64] Nor is the cost of full treatment covered in any province in China. Outside of Shanghai, the medications are given free of charge but no other medical costs are catered for, such as consultations, scans nor auxiliary medications, for example.

[65] Indeed, this could be said of DOTS in all countries as the policy mandates that there be an availability of antibiotics drugs but not support for hospitalisation costs, drug side effects, etcetera.

[66] This freedom of movement has been severely reduced and highly controlled throughout China during the SARS-CoV-2 pandemic (2019-2022), however.

economic status. Attending to reimbursement records, therefore, contextualises surveillance statistics. It further expands understanding of patient management, the challenges patients face, and the invisible labour health professionals perform to help their patients continue or finish their treatment, as discussed in Chapter Five.

The present chapter seeks to explore how surveillance work and the primacy of quantification conjures, maintains and perpetuates the epidemiological imaginaries upon which they are based. The following ethnography describes the dynamics of this indicator culture (Merry 2016) and demonstrates the production of 'data inertia' wherein "existing data determine what an existing indicator can measure" (Ibid. 7). Further drawing from Merry, the next chapter will explore the production of expertise inertia whereby "insiders…have a greater say in developing measurement systems than those without" (Ibid. 6). Chapter Four and Chapter Five thus stand independently in examining these dynamics of indicator culture, and together to demonstrate how indicators for DOTS may fail to undergo refinement due to the programme's focus on quantification and its fixation on metrics that lead to the recursive production of data and expertise inertia. This chronic misalignment between policy and the everyday realities of patient management may contribute to the rise in acquired microbial resistance (AMR), patients' resistance to policy demands, and the resistance health professionals experience towards their work and how they must carry it out (Lipsky 1980).

The following will first recount a municipal outbreak and monitoring presentation and introduce some of the indicators that are officially surveilled for and considered to constitute tuberculosis control. This will run alongside a concurrent discussion on indicator culture and the creation and shaping of epidemiological imaginaries. The second section will sit in on an evaluation of patient reimbursement files and demonstrate the richness of the social, economic and political contexts inscribed in these documents that, crucially, expand beyond the official indicators. This detail communicates a complex relationship between patients suffering from a disease of inequality and the financial demands of recovery in a contemporary metropolis. Juxtaposed with the first section, this ethnography reveals the *maodun* inherent in measuring patients' treatment progress through indicators divorced from lived context. The final section examines how the apparatus or tools used to collect this numerical data confound the possibility of indicator refinement. Instead, they ensure that only data that conforms to what is expected according to pre-existing epidemiological imaginaries is fed back into the disease surveillance system, maintaining indicator status quo.

INDICATORS OF PROGRESS, MONITORING IMAGINARIES

"Now we'll have Dr. Qin (钦) present us with the month's tallies", the SCDC head of epidemiology announces. Dr. Qin, sitting beside me, stands and makes her way down to the podium with a relaxed stride. These monthly feedback (反馈; *fankui*) sessions are a part of her job as head of Outbreak and Monitoring (疫情和检测; *yiqing he jiance*) and she is clearly used to addressing this crowd made up of heads from the district CDCs and designated hospitals. As Dr. Qin sets up her presentation, I look around the room again, taking it all in.

We're in the main auditorium in the SCDC. It's a semi-circular room on the first floor with floor-to-ceiling windows along an arc. One enters the amphitheatre-like space via the top row, the subsequent lines of tables and chairs graduating each row lower, extending into the belly of the enclosure. The design allows for natural dimness within the room, with the large audience receding into the darkness during presentations as attention is drawn towards the stage. The light afforded by the top row of windows and the lit presentation screen in front offer just enough illumination for notetaking. The speaker seems to disappear into the dimness as I focus on the rows and columns of epidemiological statistics projected brightly in front of me.

The numbers are meaningful for the audience in the auditorium. District representatives squint and study the quantified information representing the fruits of their work and how their efforts compare with those from other districts – the competition between districts is respectful albeit serious as these league table rankings impact funding and salaries. Meanwhile, Dr. Qin comments on each of the slides as she makes her way through the month's epidemiological surveillance figures. She calls attention to points of note as well as collegially alerting her audience to missing information now outstanding.

Dr. Qin's presentation offers a powerful performance of indicator culture in action – powerful in the unquestioned and routine way it defines and shapes tuberculosis control reality. Officialised rituals such as these monthly meetings (re)articulate and (re)affirm that DOTS has been carried out and that public health work has been done. On these occasions, the practitioners of indicator culture gather around the numbers and metrics that irradiate from centre stage. Paramount attention is paid to these non-humans that define categories of interest and measurements of social phenomena deemed worth counting, to the exclusion of other aspects judged not so worthy.

The following will discuss what is enabled by the practice of quantification and performed through the use of indicators. This discussion will run alongside Dr. Qin's presentation that demonstrates indicator culture in action. It will examine how the reported metrics come to inform the formation of epistemological imaginaries premised on specific standards, parsed into categories, and conjured through the assertion and reinforcement of indicators backed up by numerical justification. These imaginaries permeate the national and international levels and are fed back into policy design. This tautological process can generate 'data inertia' (Merry 2016, 7) that leads to data inertia, and so on.

> *Dr. Qin begins by comparing current indicators with those from the same time last year across all districts (Table 5). Although many are projected onto the screen, she specifically calls out those for 'prevalence', 'sputum-smear testing', 'new local infections', 'new non-local infections' and 'new sputum-smear testing'. These indicators are some of the most salient for the task of epidemiological outbreak and monitoring. They represent the total number of patients in Shanghai, how many undergo timely sputum-smear testing, how many patients are of Shanghai* hukou *and how many are not, and the number of new patients, respectively. The concern with disease spread, patient compliance, and patients' socio-political status are surveilled and compared across the conditions of time and space.*

Comparative % Rates for Jan. and Feb. 2013/2014																	
District	Baoshan	Changning	Chongming	Fengxian	Hongkou	Huangpu	Jiading	Jing'an	Jinshan	Minhang	Putuo	Pudong	Qingpu	Songjiang	Xuhui	Yangpu	Zhabei	**Total**
Prevalence																		
Sputum-smear Testing																		
New Local infections																		
New Non-local Infections																		
New Sputum-smear Testing																		
Deaths																		
Municipal total																		

Table 5: Indicators for surveillance comparison between Jan-Feb 2013 and Jan-Feb 2014.

> Good afternoon, everyone. Here are the Outbreak and Monitoring tallies this month. Firstly, we have the statistics comparing the present epidemiological figures with those of this time last year. Looking at them, we can see that prevalence has increased by 10.57% in the municipality. Sputum-smear testing has decreased by 13.1% during January and February. We usually see this around this time of year, possibly due to effects from the Spring Festival holiday period, but it's a decrease, nonetheless. Current floating population infections compared with this time last year have also decreased by 2.6%. New sputum-smear testing rates are lower by 20.41%.

As defined by Merry (2016), the method of quantification enables phenomena across different social worlds to become commensurable and countable through their conversion into numbers.

> Quantification depends on constructing universalist categories that make sense across national, class, religious and regional lines. Categorised numbers can then be bundled together into more complex representations of social phenomena, such as good governance or the rule of law. These numbers convey an aura of objective truth and scientific authority despite the extensive interpretative work that goes into their construction. (Ibid. 1)

Categories deemed universalist and representative of social phenomena are constructed based on particular epistemologies. Such categories may be 'eligibility', 'success', 'control', or 'risk'. Becoming comparable across conditions of space and time entails being stripped of history, context and meaning, and being further broken down into indicators assumed neutral and objective. These indicators are assumed to represent the constitutive markers of a social phenomenon and are measured numerically.

The global rise of interest in indicators during the latter half of the twentieth century has culminated in a now ubiquitous 'indicator culture' that informs a new form of public management embedded in the logics of evidence-based decision-making through counting (Merry 2016, 2011). Springing from a desire to confront issues such as transparency and equality in the mid-1990s, this new governance is couched in accountability. Responsibility and blame are measured and accounted for through the use of indicators in evaluations and audits. The successes, efficacy or, indeed, inefficacy of a government, programme or individual in office can be quantified, represented as statistics or visuals,[67] and compared with others or with itself across conditions. Official endorsement further bolsters and establishes the validity of

[67] For example, see Engelmann (2019).

indicators as real attributes of the world. Their popularity follows from their simplified design; easily understandable and applicable across contexts, being themselves stripped of context. Their alignment with numbers infuses indicators with an aura of objectivity, apoliticism and expertise. The combination of these multiple aspects instils belief and trust in the power of numbers, and in indicators as the constitutive markers of the road to progress.

Dr. Qin continues through her slides on the previous month's figures for second-month and fifth-month sputum-smear testing. For each of these indicators, again divvied up by local and non-local hukou*, she calls out the number of registered tests, number of missing test results, and number of deaths (Table 6). In doing so, she establishes the STP's ability to ensure knowledge of and control over patient compliance. Missing data, therefore, threatens this assertion and Dr. Qin takes the opportunity to directly request tardy districts to submit their metrics. This exchange further performs the municipal level's managerial power over district personnel.*

Second/Fifth-month Sputum Smear																	
District	Baoshan	Changning	Chongming	Fengxian	Hongkou	Huangpu	Jiading	Jing'an	Jinshan	Minhang	Putuo	Pudong	Qingpu	Songjiang	Xuhui	Yangpu	Zhabei	**Total**
Local																		
Non-Local																		
Missing																		
Missing Non Local																		
Deaths Local																		
Deaths Non-local																		
Municipal total																		

Table 6: Indicators for second-month and fifth-month sputum smear tests.

The following are the figures for last month's second-month sputum smear testing. We've recorded ninety smear-negative results. Fourteen patients' test results are missing, however. Of those, twelve have been accounted for and two have not. There has also been one death. We haven't received explanations for why the two smears haven't been carried out yet, let's have a look at which districts are responsible. [Dr. Qin searches for the relevant values on the slide]. It's Jinshan and Songjiang who haven't given us an explanation.

Please go back and check your records for these cases and let us know the reason why they are missing.

Indicator culture is a set of practices based on the belief that technical expertise and rationality will generate practical and instrumental ways, rather than ideological ones, of managing social phenomena. Concurrently, this mode of measuring the world also allocates the placement of accountability and blame. Late twentieth-century China saw a shift in its governance from one steered by the political ideology of Maoism to one headed by a CCP eight-ninths composed of China's new class of 'red' engineers (Andreas 2009) and their emphasis on the technocratic. In the area of public health, the CDC model was adopted based on "its emphasis on prevention, accomplished by the skilful use of 2 scientific disciplines: epidemiology and laboratory science" (Peng et al. 2003, 1992). Data-driven empiricism in determining the social dynamics of disease – that is, epidemiology – is an approach now dominant in public health, with its rationale retold again and again in the form of an epic narrative consisting of heroes wielding the heroic power of science and technology (Cabral, Pandey, and Xu 2022). These epic narratives uphold the power-knowledge relations that privilege a "hegemonic modernization paradigm" manned by "heroic individuals or organisations" that solved "pressing national imperatives" and made "unprecedented achievements" (Ibid. 249).

The origin story of the US CDC is one such epic lore (e.g., Thacker and Stroup 2013; Choi 2012; Etheridge 1992). Part of this lore is the now almost legend of how Alexander Langmuir established the Epidemic Intelligence Service (EIS) in 1951 in response to biological warfare anxieties during the Cold War period and at the behest of the founder of the CDC, Dr. Joseph Mountin.[68] The officers of this unit were known as the 'boots-on-the-ground disease detectives' who engaged in applied epidemiology by physically going into the field and doing the legwork to investigate outbreaks and collect disease-related data. Their efforts came to constitute the practice of modern surveillance, and their repeated successes in, amongst others, malaria; polio; Asian flu; hepatitis; encephalitis; as well as in other areas such as abortion and family planning, instated epidemiology as a central component of public health work.

[68] Indeed, this story continues to be upheld and retold through popular publications by science writers and journalists (e.g., Pendergast 2011; McKenna 2008) in which EIS officers are depicted as special forces and the public's first defense against a world of known health dangers as well as those unknown but yet to come.

The context and timing of this epic lore, set in the period of Cold War politics, contributed to the global dissemination of this approach. At this time, the U.S. had become the biggest global power and major U.S. institutions such as the Rockefeller Foundation were funding the proliferation of science-led ventures on a global scale. The importance of such projects as the Green Revolution, for example, was spurred by the urgency of using science and technological advancement to prevent a (communist) Red Revolution (e.g., Schmalzer 2016). Modern surveillance was thus a political as well as health-related preventative measure developed by the actions of these heroic experts who monitored not the individual but, rather, populations and the dynamics of disease(s) within them. The telling and retelling of these narratives celebrate and sustain the legitimacy of epidemiology and surveillance and, by proxy, their use of numbers and indicators as the ultimate techniques of public health management in the global project towards progress.

> *Timing is of the essence in the modern epidemiological surveillance of infectious disease and Dr. Qin makes sure to draw attention to rates of timely information reporting and first-contact meetings with new patients. Having the technological infrastructure for real-time reporting is one of the requirements for modern infectious disease control. In Shanghai, this is paired with paper documentation for corroboration, including the incident report cards on which patient history is inscribed. Although Dr. Qin emphasises the importance of case history for patient monitoring, her main concern lies with whether the card upon which the history is recorded on is in possession and not the history itself (Table 7).*

Paper Reporting																	
District	Baoshan	Changning	Chongming	Fengxian	Hongkou	Huangpu	Jiading	Jing'an	Jinshan	Minhang	Putuo	Pudong	Qingpu	Songjiang	Xuhui	Yangpu	Zhabei	**Total**
Case registration on time																		
First contact made on time																		
Incident report cards on time																		
Case histories for ss+ on time																		
Municipal total																		

Table 7: Indicators for timely paper reporting.

Reporting in-time [报告及时里; *baogao jishili*] is at 99.15%. Timely patient first-contact meeting is 100%. Paper reporting is 100% accurate and there have been no mistakes or repetitions. All paper report cards correspond with the entries registered online. Next, we have incident card comments. It's very important for us to see and record a satisfactory case history. We are missing two of these histories, one from Pudong and one from Fengxian. I hope you can return to your offices and find a way to figure this out. We must ensure that we've performed our responsibilities as according to protocol and management [管理工作到位了; *guanli gongzuo daoweile*].

Dr. Qin further stresses the importance of monitoring the treatment of DR-TB patients. Patients undergoing treatment for one year or more have complex infections that may require adjusted regimens. Failure to properly manage these cases can result in an increase in one of the most concerning indicators for the present and future of tuberculosis control (Table 8).

One-Year Treatment Status																		
District	Baoshan	Changning	Chongming	Fengxian	Hongkou	Huangpu	Jiading	Jing'an	Jinshan	Minhang	Putuo	Pudong	Qingpu	Songjiang	Xuhui	Yangpu	Zhabei	**Total**
Local Continue																		
— ss+																		
— ss-																		
Non-Local Continue																		
— ss+																		
— ss-																		
Local Discontinue																		
Non-local Discontinue																		
Municipal total																		

Table 8: Indicators for one-year treatment status.

Now we have the list of patients that are approaching one year of treatment from each district. Please go back and check what their current status is and whether they are to discontinue or continue treatment. Please report to us as soon as possible if there are difficulties in determining patient status and we

can also present their case at our monthly expert sessions for consideration.[69] Once again, this is to remind everyone not to overlook these patients approaching one year of treatment.

Indicators are far from apolitical. "...they reflect the social and cultural worlds of the actors and organizations that create them and the regimes of power within which they are formed" (Merry 2016, 4-5). Particular assumptions and understandings of what constitutes health, treatment, cure and even disease determine the kinds of indicators that become officialised by experts in institutions. These judgements are based on their perspectives in positions of power and as bearers of technical knowledge. Their visions and expectations of how recovery, compliance and success should look like set the standards against which categories are upheld and indicators are measured. The standardisation of these standards renders them mobile and commensurable across space, time and the social worlds they are inserted into (Timmermans and Epstein 2010). The cultural, political, moral as well as technical assumptions that inform their creation are thus imposed locally (e.g., Graham et al. 2021).

Dr. Qin concludes with a slide on school outbreak and monitoring. In these events, protocol stipulates timely reporting, disinfection of the patient's dormitory, close-contact screening and observation, and the identification of suspected cases. The numbers indicate the successful handling and completion of this incidence of potential mass infection and, in doing so, the district personnel have managed to maintain incidence rates below the indicator for failed mass infection control (Table 9).

[69] Clinical pulmonary experts gather with SCDC patient-monitoring staff once a month to consult over complicated DR-TB cases to determine next steps for treatment.

School Outbreak and Monitoring																		
District	Baoshan	Changning	Chongming	Fengxian	Hongkou	Huangpu	Jiading	Jing'an	Jinshan	Minhang	Putuo	Pudong	Qingpu	Songjiang	Xuhui	Yangpu	Zhabei	**Total**
Incidence reporting																		
Case registration																		
Follow-up																		
— Close-contact tracing																		
— Suspected-case management																		
— Environmental Disinfection																		
Municipal total																		

Table 9: Indicators for school outbreak management and monitoring.

> Finally, we've had twenty-five school outbreak incidences in January 2014. Within those twenty-five, six incidences were all in one school in Pudong's Nanhui sub-district. These six cases were found to be epidemiologically linked. All tasks were successfully carried out, including close-contact screening [密接筛查; *mijie shaicha*], close-contact observation [观察; *guancha*], identifying suspected cases [疑似病例; *yisi bingli*], and suspected case observation for positive infections. All necessary follow-up reports for these tasks have been received. So for now, we've carried out everything we're supposed to, and we hope that there won't be more incidences. Fortunately, there weren't ten incidences – we were just one away from ten incidences and points being deducted, *a chuckling Dr. Qin reminds her audience.*

Indicators, therefore, create their own realities. They fix the data they are designed to collect. The design of apparatus (Barad 2007; Landecker 2007) invented to collect data for indicators is itself based on specific assumptions about the world and how it works. An echo chamber is created, and "Rather than revealing the truth, indicators create it…[however] the result is not simply a fiction but a particular way of dividing up and making known one reality among many possibilities" (Merry 2016, 5). The data available determines what an indicator can measure, and an indicator determines what an apparatus can collect. This circular feedback loop – indeed, this *maodun* – tends towards the generation of 'data inertia' (Ibid. 7) and the sustained

creation of partial and limited worlds by delineating what gets counted and what gets excluded from consideration. Through enacting the surveillance of infectious disease control, epidemiologists conjure epidemiological imaginaries of the social that play an important role in creating the world (Reubi 2020). The data collection and statistical interpretive work epidemiologists perform tell stories about societies and people that feed into the design of global health policies and programmes created to manage the social worlds evoked by those stories. Examining the nature of these data, determined and bound by indicators and the apparatus designed for their collection, is therefore of the utmost importance for understanding the kinds of policies that are enacted and programmes that come to be.

> *Dr. Qin concludes her report by asking if there are any questions. There are none, just murmurs amongst the audience, many of whom have their head raised, studying the lit table of metrics on stage.*
>
> Until next month then.

Dr. Qin has run through some of the most salient indicators focused on in these monthly meetings. There are many other indicators, of course, but these ones receive particular attention as they surveil the aspects most important to DOTS and the STP – incidence, direct observation and timely reporting, patient compliance, and drug resistance. The performance of this ritual (re)instates that numerical data has been collected and that work has been carried out – public health in the making. The reported statistics assert whether an event took place and the cross-referencing alerts to whether information may be missing and who is responsible. Thus, these metrics exert a second surveillance of health professionals' work performance and accountability (discussed in Chapter Five). They do not measure other kinds of information considered superfluous to tuberculosis control, however, such as patients' history, context and circumstance. The following section will turn to another form of surveillance that does.

READING BETWEEN THE REIMBURSEMENTS

Beeep! ...Beep beep! The sound of highway traffic whooshing by, fast. A deeper drone from a truck: Hooonk!

Beep beeep! The machine-gun clanking of construction drilling starts up again.

The cacophony of afternoon traffic a few streets away intrudes through the open window of the office where we're sitting at a table with a stack of patient files and receipts. It's early spring and the sun has returned with a bit of warmth in it. This seems to have everyone in bright spirits on this evaluation day (see Chapter Five for more on Evaluation Day). I'm observing with the municipal staff and we're visiting the finance department of a district CDC. We are examining the reimbursement files for all patients currently undergoing treatment, archived files for those who have completed treatment, and financial records for the department and its staff are all managed and stored here. The approved claims and total amounts have already been sent to the municipal tuberculosis finance section and the purpose of today is to pull out some files to cross-check that everything has been calculated correctly. The district staff will lose points if the numbers do not correspond or if reimbursement standards have not been upheld, so great attention has been paid to each hospital receipt saved and ledger line filled in. The patients' reimbursement files look as neatly presented as Dr. Qin's aggregate statistics and tables but the information they record fills in the local and quotidian realities of tuberculosis treatment for the individual patients living in Shanghai in lieu of stripping them away.

No two patients have the same experience of treatment when read through these files. Indeed, they show up the *maodun* inherent in the assumption of standardisation as asserted by Dr. Qin's indicators that are designed to flatten and make disparate instances of infection commeasurable. Personal details such as local or non-local *hukou*, young or elderly, resident or non-resident all make a difference to how much money a patient is eligible for whilst undergoing 'free treatment'. Social, economic and political lines determine coverage, the contours of which can be gleaned from examining the allocation of funds within the programme. Moreover, claims are only possible with a receipt *indicating* that a central and reimbursable task has been undertaken. These ledgers, therefore, operate a form of surveillance by evidencing which aspects of tuberculosis treatment control have or have not taken place. Drs. Ruan (阮) and Cai (蔡) are our guides through the world of reimbursement finances. They will explain the ins and outs of the policy and how it intersects with China's withdrawal from a fully state-supported healthcare system to adopting a more market-based approach. As put by Dr. Ruan: "spending money is a complicated matter".

Alongside the tuberculosis treatment funding in Shanghai, all Shanghainese with a local *hukou* are entitled to state-sponsored public health insurance called *yibao* (医保). One possesses a Shanghainese *hukou* if one is born in Shanghai or, if eligible,

converts their original *hukou* to a Shanghainese one through a points-based internal migration system that appoints each applicant with marks based on attributes such as their level of education, number of years of employment, place of employment, and income. This means, therefore, that only locals and the economically stable possess Shanghainese *hukou* and *yibao*. Not all Shanghainese *hukou* are equal, however. An individual's *yibao* allowance depends on their income and how much of it they pay towards their insurance, with the state paying another part of the total monthly contributions. Those with higher income can afford to pay more towards their health insurance and receive more allowance when the time comes. Any money that isn't used up in one year can be carried forward into the next year, and so one's *yibao* acts as a medical expenses account one saves until such time as it is needed, having possibly accumulated tens of thousands of RMB by that time. Having access to such a savings nest makes a significant difference to the weight of financial costs tuberculosis patients are burdened with, particularly if initial hospitalisation is necessary. Dr. Ruan pulls open a file and starts to explain.

> Look at this patient. Their overall bill was RMB 1,400 but they only paid RMB 140 in cash. So we just have to reimburse them RMB 140. They have receipts for first-line drugs, so we know that they did not have a drug-resistant infection. This other patient, I'm sure they're non-local…yes, they're not Shanghainese. Their bill came to RMB 6,000 in the end. He submitted forty-eight receipts. These receipts have the hospital name, the receipt number, the procedures undertaken, medications prescribed, and it's clearly written which costs were covered by *yibao* and which are self-paid. All of his charges were self-paid. He will be reimbursed for the tuberculosis examination and medication costs only, not the other expenses that make up the bulk of the total amount. As you can see, the cost of treatment is much more substantial for non-local patients.

To understand these two files, it is necessary to know how the details of the *yibao* system determine the cost of 'free treatment' for tuberculosis in Shanghai. Dr. Ruan describes it as the best medical insurance system in China because it covers both outpatient and inpatient fees. This is unlike in other provinces that only cover inpatient fees by way of a lump sum given at the beginning of the year. Any other costs have to be covered by the patient. The municipal system is centralised and patients need only swipe their *yibao* cards in any state medical setting to access their funds. They also have a *yibao* book which contains their medical history, prescriptions and received medications; this record also prevents patients from getting repeat prescriptions from different clinics. Finally, all medical settings, including the main pulmonary hospitals, will print a standardised receipt that clearly lists the procedures

undergone and which were paid through *yibao* and which were self-paid. A patient can decide whether they want to pay themselves or through their *yibao* account and only self-paid costs will be reimbursed for tuberculosis treatment. These receipts are triple checked: by the community health doctors, the district CDC reimbursement section when calculating a patient's reimbursement, and by the district finance department before submission to the SCDC.

The heftiest costs are incurred during initial diagnosis and treatment when hospitalisation may be necessary. The tuberculosis reimbursement covers one chest X-ray, six sputum smears, drug-resistance testing (DST) for four (first-line) antibiotics, liver protection drugs,[70] and antibiotic medications. The costs of these resources are fixed and do not change throughout treatment, even if the duration is extended. The policy does not cover all other in-patient costs such as renting the hospital bed, the full gamete of blood tests, CT scan, ultrasound, bronchoscopy, intravenous glucose and electrolytes, and any other costs that may be necessary or have become standard upon hospitalisation in China[71] due to the political and economic focus of decades of healthcare reforms.[72] The final cost may be into the thousands of RMB upon discharge depending on severity of illness, duration of stay, and the quantity of healthcare provided.[73] A patient with a Shanghainese *hukou* can use their *yibao* funds to pay the total bill or part of it. Dr. Ruan showed me the file of another Shanghainese patient whose *yibao* covered RMB 5,580 worth of in-patient fees. A patient without a Shanghainese *hukou* must pay the bill in full out of pocket. With non-local *hukou* migrants comprising the largest patient demographic in Shanghai, this crucial financial delineation makes a significant difference to patients attempting to recover from a disease of inequality and, presumably, impacts their ability to do so. This contradiction or *maodun* is clearly inscribed in these reimbursement records.

Due to *yibao* support, the tuberculosis reimbursement policy ends up paying more for floating population non-local patients in Shanghai than it does for those with Shanghainese *hukou*. Even though some Shanghainese *hukou* patients receive more financial support than others, non-local patients are more likely to have DR-TB (D. Li et al. 2016), endure longer treatment duration, and have higher medication costs. These patients are reimbursed monthly or every 3 months due to their treatment being so

[70] For a maximum amount of RMB 800 only. If the cost of liver protection drugs exceeds this amount, the excess is not reimbursed.
[71] See Tu (2018) for a comprehensive study on current practices in the healthcare sector in contemporary China.
[72] See W. Yip and Hsiao (2014) for more on China's healthcare reforms.
[73] Patients may be refused treatment if they do not settle their bills or 'recharge' their hospital account to show sufficient credit prior to receiving treatment.

long, of which only 51% recover, according to my interlocutors. The policy in Shanghai is different from elsewhere in the country, whereby only medication is covered and nothing else. I asked if healthcare costs are particularly expensive in Shanghai. Dr. Ruan explains, pointing to some circled costs on a patient's reimbursement receipts,

> The medications are very actually very cheap. Ethambutol is RMB 9, a pack of rifampicin capsules is RMB 28. In fact, a complete 6-month course of tuberculosis first-line drugs is RMB 500 in total [approximately GBP 59].[74] It would be more for second-line drugs of course. These are prices set by the municipality and do not change.

She reminds me again that it is the initial hospitalisation costs that incur the bulk of the main financial burden for patients.

There is a history of financial support provision for tuberculosis patients in Shanghai. Before the SCDC was established in 1998, a small allowance was given but only to patients from the countryside or those who were issued supporting evidence of their financial disadvantage by their neighbourhood committee (居委会; *juweihui*).[75] During the years of Global Fund support for MDR-TB in China (2006-2014), non-local *hukou* patients with drug-resistance infections received travel allowance and what was called 'poor subsidies' until most projects ended in 2014 (Lixia Wang et al. 2017).[76] Now, only some more affluent districts like Minhang and Pudong can still afford to provide their patients with travel and living expenses. All health professionals commented that this support was crucial for patients but because it is not a component of the DOTS policy, it was considered an extra and not essential. Liver protection drugs are also not stated as being a part of DOTS but they are considered essential by clinicians in Shanghai, particularly for patients over sixty and those with diabetes, due to the damage caused by the treatment antibiotics. Shanghai's DOTS policy subsequently made the decision to include the reimbursement for these drugs. Eligible patients can be reimbursed for a total of RMB 800; 100 per month for 8 months of standard treatment. "Countries count what they care about" (Merry 2016, 14) and making liver protection drug costs reimbursable not only supports patients' ability to complete their treatment but also incentivises patients to use them and health professionals to attend to their patients' usage.

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[74] Conversion rate of RMB 1 = GBP 0.1179 on March 29th, 2021.
[75] The office responsible for governmental administration at the community-level. They are the front-line interface with residents.
[76] A mixture of Global Fund funding and monies from the Chinese Ministry of Civil Affairs financed these subsidies (Lixia Wang et al. 2017, 8).

Negotiations for how present-day patient reimbursement would operate began in 2000. The SCDC staff had wanted to directly transfer a lump sum of RMB 1,500 into the bank accounts of new patients to cover costs for the duration of their treatment. The municipal finance department wouldn't permit this, however, because it already paid *yibao* for its citizens and so would be doubly compensating some patients with local *hukou*. Whereas the SCDC had wanted to incentivise the patient, the municipal finance department came from a more fiscal perspective. In the end, the SCDC had to concede to the municipal finance department as they controlled the purse strings and the current system of using health professionals to calculate reimbursement claims by hand was decided upon in 2003.[77] Dr. Cai explains that,

> Every year, the Central CDC [in Beijing] ask us for the *yibao* rates for local patients. I tell them that we can't fill out this form. Instead, they can go onto the website and check the rates and see how these rates depend on different demographics, different age groups, different occupational industries…
>
> And different hospitals reimburse different procedures and not others. You could do a separate project on *yibao* and it would be a very big project! The system has been refined over many years into a form that everyone is now happy with. Shanghai took example from healthcare systems in other countries, including the private insurance model. Our system aims for 'low level, wide coverage' [低水平广覆盖; *dishuiping guangfugai*]. It covers standard health issues like high blood pressure and diabetes. More specific or serious illnesses are not covered so you can buy extra private insurance and be doubly covered that way. Not everyone will buy private insurance though. Not young people. Maybe the elderly, but those with lower income like the floating population from the countryside, they might not have the understanding to buy this kind of insurance.

These files lay bare the socio-economic inequalities that exist in contemporary China that are in large part incurred by how the *hukou* system categorises people as a form of population control. Dr. Cai mentions, in particular, the floating population of migrant workers who come to Shanghai from a rural setting in search of work in order to send home remittances because they are the demographic most likely to contract tuberculosis. They take up informal work like, for example, house-cleaning, child-

[77] In 2014, the municipality was setting up a centralised online platform for inputting these reimbursement applications. Community health doctors would then have to input the details online as well as putting paper files together.

minding, construction, and setting up temporary food stalls (as discussed in Chapter One). They are not employed by an established work unit or *danwei* and so do not pay social benefits nor receive medical insurance. In order to save and send as much as they can home, migrant workers are likely to live in impoverished environments, crowded and with poor ventilation. Living and working under these conditions, it is unlikely that migrant workers will seek out and pay for expensive private health insurance. Dr. Cai elaborates:

> Like those [migrant workers] working in Shanghai now, they don't [buy private insurance]. So if they get sick and have to pay for healthcare, then what they earned previously was for nothing. So that means that even for small illnesses, they don't go to get them checked out. Only if they can't deal with it anymore do they go to get it [their illness] looked at. The national policy for tuberculosis is that all patients can receive free treatment no matter if they're local or not. But now, non-locals might not be covered by the new policy we've been discussing.

Dr. Cai and Dr. Ruan had previously been sharing their confusions regarding a new amendment freshly issued from the Shanghai Municipal Health Commission and how it would work in practice.[78] National policy states that every person diagnosed with tuberculosis is entitled to 'free treatment'. The new amendment stipulates that in Shanghai, non-local patients must be in possession of a resident's permit to be eligible for 'free treatment', for which they must be registered in an established work unit to apply. Otherwise, they will receive no reimbursement for medical expenses. And as per the original policy, tuberculosis patients are not permitted to work until they are pronounced cured. This makes it impossible for migrant workers to survive in Shanghai whilst undergoing treatment. And this is the point, Dr. Cai informs me,

> They [the municipal government] just want them to go back home for treatment. The city is worried because there are so many non-locals in Shanghai. Some districts have 200 patients per doctor to manage and th majority of them are non-locals. The money doesn't come with the person to Shanghai, it's Shanghai giving out the money to support them.[79]

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[78] The Shanghai Municipal Health Commission (上海市卫生健康委员会; *shanghai shi weisheng jiankang weiyuanhui)* regulates the healthcare system for the municipality. It is the municipal-level administrative body for the National Health Commission, which does the same for the country. The SCDC comes under its jurisdiction and must implement policy decreed by the Commission.

[79] Notably, this reasoning does not include the economic indispensability of migrant workers, whose physical toil constructed larges areas of the metropolis and continue labour maintains the everyday running of the city.

This new policy presents many *maodun* for patient reimbursement and their *guanli*. Firstly, Dr. Ruan points out that not all migrant workers will or intend to apply for a permit, nor will they end up being employed in an established *danwei*.

> Things have changed and now the resident's permit is much harder to get since the introduction of the temporary resident's permit. This has already affected migrant workers' ability to find housing because landlords must confirm that the potential tenant has a resident's permit when signing contracts. Even if you become eligible for a resident's permit, it takes months to process. Therefore, if a patient receives a resident's permit, are they reimbursed for their expenses from that date or do they backdate the payments to the point of diagnosis? Prior to their eligibility for reimbursement, how can you *guanli* them? The purpose of the reimbursement system is to incentivise patients' compliance with their regimens and their doctors. If the patient is not eligible for reimbursement, then what of health professionals' ability to manage them? In terms of registration, do you register them in Shanghai or where they're from? If you register them as being from outside of Shanghai and they don't go home, their treatment will not come under the *guanli* of the other province either. If registering them where they are from is not a solution, do you not register them at all then? If you don't financially support them and they can't work, they'll do 'other things'.

Nodding, Dr. Cai adds,

> And there's the wider policy of tuberculosis treatment being free for everyone. Do we just abolish that?

This was evaluation day and we only looked at the completed files of cured patients who had already been fully reimbursed. In the next chapter, community health doctor Dr. Sun (孙) describes her daily maintenance of ongoing reimbursement files for her patients, where she too can see the progression of and inconsistencies in their treatment. The majority of her over one hundred patients are non-local and she has arranged a rolling monthly reimbursement schedule for some of them, even if they do not have a DR-TB infection, as they cannot afford to wait until they are cured.

Enacting a form of surveillance, patients' receipts evidence treatment compliance and control, and patients' reimbursement files maintain a record of this activity. They list which area of the city the patient attends clinic and whether they

undergo examinations and refill prescriptions in a timely manner. Beyond the standardised indicators of tuberculosis control, the receipts also tell the story of how much a patient's recovery is costing them and whether they are paying the full cost themselves or with state support. These details, coupled with where the patient's *hukou* is from and whether they have a resident's permit as per the new policy amendment, expand the imaginary of the patient painted by numbers. This picture is further filled in with the details of which drugs they pay for, indicating whether they have a drug-resistant infection; adjustment of this prescription may indicate treatment status; and other co-morbidities the patient may have. This richer imaginary of the patient is constructed (because it too is but an imaginary, albeit a more detailed one) by reaching beyond the numbers set by categories, standards and indicators – reaching for the receipts that document how much patients with a disease of inequality have to pay to get better. Reading the surveillance of patients' treatment through reimbursement files expands epidemiological imaginaries to include the local particularities and quotidian experiences of tuberculosis recovery for individuals in Shanghai. As put by Dr. Ruan, "You see everything there."

"STICK TO THE FORMAT!": USING TOOLS

This section examines how the tools used to collect numerical data for indicator measurement function to maintain those same indicators and the standards from which they were born. I exemplify this by recounting a training session given by Dr. Qian (钱), who manages reimbursement in a district CDC. Dr. Qian pays a lot of attention to her job. She receives the reimbursement applications from the community doctors and it's her job to spot mistakes and discrepancies in the accounting, which items are being claimed, how many times, etcetera. She explained to me that it takes her so much time having go through the files and correct these mistakes that she has designed an Excel spreadsheet with formulae and formats that she will ask all community doctors to use instead of submitting handwritten ledgers. "That way, the spreadsheet will ensure that all the accounting is correct and the doctors won't be mistaken about what can and can't be reimbursed as it'll be indicated by the categories written right there!", she said. I detected a tinge of impatience in Dr. Qian's voice as she expressed this last sentiment.

The training session was held for all tuberculosis community doctors in the district. Dr. Qian stood at the top of the room to introduce the new Excel spreadsheet and how to use it. Her computer's screen was projected onto the wall and we could

see that the sheet was long. It included all reimbursable items, including those post-initial diagnosis and throughout a treatment duration. After giving a short introduction, she focused on the areas where she usually encounters the most errors.

> We're training up this tool because there are always problems. The spreadsheet is made exactly for this task. Please don't widen the boxes to write more; you don't need to if you're inputting correctly. If your entry turns red it means it's correct, if it turns black it means there's an error. And you must write the date in this format, don't widen the box!
>
> You can only claim for a chest x-ray once.
>
> All aspects of urine analyses are included. Colour, transparency, pH, all of these can be reimbursed. And it's the same thing even if different hospitals call it by different names. The Eighty-fifth Hospital calls it 'urine testing' but it's the same as 'urine analysis'.
>
> Kidney function reimbursement is very clear. RMB 5 for each kidney. It's RMB 8 for acid urea testing. [She receives a question from a doctor].
>
> It's written as tuberculosis antibodies [结合抗原; *jiehe kangyuan*] and it says on the excel how it can be reimbursed. You can only reimburse this RMB 50 once. So even if the test costs RMB 60, you can only reimburse RMB 50. And you can only reimburse it if it's written in that format.
>
> Liver function testing can be reimbursed six times, but it's not monthly so pay attention. [A doctor in the audience says that he has a lot of patients who are required to do it every month]
> You can only reimburse six of them.
>
> For sputum smear testing, only the first 1 is reimbursed RMB 45, the rest of them are reimbursed RMB 60, that's RMB 30 and RMB 30,[80] only for both the 2nd- and the 5th-month examinations. DST is only reimbursed once, RMB 40 for 6 different antibiotics so that's a total of RMB 240. Outpatient registration fee is RMB 12.[81] Don't forget that DST can only be claimed once.

[80] Two specimens are taken.
[81] Each district has its own list of reimbursables, depending on the status of their funding.

You can't write things together if they're not supposed to be together. Some of the reimbursements are standard. Others are extra that we're putting money towards. The money even comes from different sources so please don't write them in the same place.[82] The first time I'll remind you. The second time I'll penalise you. Otherwise, you'll always get it wrong.

Make sure to round the amounts up. This money is very important to patients so don't short-change them the few *mao* [毛; pence]. The document will still come up red but the cash payment and reimbursement amount might not cohere. If you make a mistake, it can only mean less money for the patient, not more. So make sure to check it all.

The rest at the bottom doesn't concern you but you have to input the top part correctly. Otherwise, it's hard to do the rest of the work. If you input it all correctly the total should come out calculated. It won't come out if you've made a mistake above. And input it here, input it here. I have to change it for you every time!

Finally, please pay more attention to details. See this account, the name at the beginning of the application is not the same as the one at the end!

Any questions?

Tools, which can also be conceptualised as apparatus, are designed by and at the disposal of the planner to practically solve an issue (Ferguson 1994). This planner may be an expert individual, institution, or even a nation-state, and according to the logics of indicator culture, practically solving an issue translates to 'measuring' it. Tools are created based on a specific understanding of what the issue is and the assumption that their use will maintain order, promote efficiency, and exert control. As in the case of Dr. Qian's spreadsheet, they are practical, save time, and ensure that rules and regulations are adhered to. It ensures that only the items that are reimbursable are claimed for whilst also ensuring that only the items that are reimbursable *are* claimed for. It does this by defining the nomenclature for these expenses to the exclusion of other names. It also demarcates the amount payable for each item to the exclusion of alternate totals. Together, the spreadsheet limits the sum of money the state is required to compensate whilst asserting how much

[82] The district uses money from its own coffers to provide this funding for patients.

compensation patients ought to receive – while Dr. Qian created the tool to avoid having to correct recurrent mistakes, it is also clear that she wants to ensure patients receive the full amount they are entitled to. Finally, the tool is designed to foster efficiency by informing and reminding community doctors of these criteria and confining their inputs within acceptable parameters only – carrying out the chore that has frustrated Dr. Qian.

Tools, as indicators that collect numerical data, are the cogs that enable the 'new governance' machine to run on quantified knowledge and enable an evidence-based approach to decision making (Merry 2016). They can become shorthand for the issue itself, if not certainly associated with tracking its progression or deterioration, and the information they collect contributes to defining and shaping a certain version of reality. Tools, therefore, produce knowledge.

> In short, consciously or not, the decision to employ a particular piece of apparatus and to use it in a particular way carries an assumption that only certain sorts of circumstances will arise. There are instrumental as well as theoretical expectations, and they have often played a decisive role in scientific development. (Kuhn 1970[1962], 59)

Operationally, tools are designed to collect particular kinds of data and in set quantities. Anything that does not conform to the categories and parameters set may be excluded from entry and users must find a way to (re)constitute the data into the acceptable form. Again, any possible reason for deviation from what's expected is stripped from the data; be it history, context or circumstance. In this way, an echo chamber is created and the programme only receives surveillance data that reinforces the epidemiological imaginaries upon which standards, indicators and protocol are based. Moreover, health professionals are evaluated on whether standards, indicators and protocols are upheld, which they labour to maintain (see the next chapter for more discussion). This cyclical dynamic creates a state of data inertia that conserves the indicator status quo and confounds the possibility of indicator refinement over time (see e.g., Landecker 2007; Foucault 1980; Kuhn 1970[1962] for writing on similar).

The above-mentioned Alexander Langmuir, who instated the centrality of epidemiology and surveillance in public health work through the US CDC, described the process of surveillance as,

> [to] have the facts, getting them accurately, interpreting them with care, making them public, correcting them when they are wrong, modifying them, being the source of the information for everyone and this idea, in a free society at least, has been one of the great secrets. (Langmuir 1979)

Langmuir insists on the features of “correcting” and “modifying” when “facts” are inaccurate as being fundamental to the surveillance process and professional public health work. Without this process of refinement, data are produced that maintain the assumptions that created these indicators in the first instance. The predominant use of quantified knowledge enables Langmuir’s expression of his political loyalties to slip by without fuss as the power of numbers exudes the scientific, the expert, and the non-political. Overall, this process sustains already instated epidemiological imaginaries that exert real effects within the realities they create, even though they are based on indicators that divide up and make known but “one reality amongst many possibilities” (Merry 2016, 5). Quoting Reubi,

> epidemiologists tell stories about the type of societies and people that compose the world and…these stories often shape global health policies and programs in powerful ways. (Reubi 2020, 438)

The telling of richer stories – ones that count the elements important to patients, such as how one navigates the everyday and copes with pressing financial burden – rather than stories stripped of history, context and circumstance may expand such imaginaries.

CONCLUSION

Surveillance considered in context makes for more informative data. This chapter has examined the task that public health professionals spend most of their time engaged in: the collection and interpretation of numbers. This activity enables the STP to surveil and, therefore, know the tuberculosis landscape in which it operates. It further informs present-day estimations of achievement and projected future planning based on epidemiological imaginaries shaped by numbers and statistics. Numbers and statistics are used due to their assumed objectivity that enables commensurability across spatial and temporal conditions, with policy and protocols being shaped by the technocratic pictures they paint. These pictures are rendered differently when considered through the lens of finance.

The above has juxtaposed the official numerical indicators surveilled for and sought after by public health professionals and patients’ reimbursement files read in the context of all their other medical costs. In doing so, I have demonstrated the discrepancies between the official and ‘objective’, and what may be considered incidental. These incidentals fill the gaps in the technocratic picture to present a fuller image of patients’ experiences of treatment and recovery, which may be useful for

understanding and further refining how patients' treatment and recovery are managed. They show up the *maodun* inherent in assumptions of standardisation that operate recursively to produce data inertia, with data inertia confounding the possibility of indicator refinement, which is necessary for policy and programme design that is fit for purpose.

Finally, the tools that are used to collect data profoundly define the nature of data that can be collected. They are not neutral but designed with assumptions and preconceptions baked in. They may define what ought to be but also limit what can be known, contributing to the production of data inertia. Health professionals are privy to both the official and incidental numbers that comprise their patients' experiences of treatment and recovery. This knowledge and experience informs their approach to managing patients, which we will explore in the next chapter.

Chapter Five

The Labour:
Seeing the Invisible

I enter the office door that morning and immediately sense the charge in the air. The scene in front of me further confirms my feelings: Dr. Sun's (孙) usual calm disposition is overridden by a discontent expression on her face; Dr. Feng (冯) has her hands on her hips and a furrowed brow, leaning over a lady I didn't recognise who is sitting at her computer; and Dr. Xu (徐) is speaking in a loud and animated voice to another unfamiliar formally dressed lady in high heels. There are multiple conversations being had at once, with most of them registering in anxious and notably defensive tones. I spy tall stacks of spiral-bound documents alongside the computers on each of the doctors' desks. No one notices my arrival as I pause at the doorway to take it all in. Then I recall Dr. Sun's warning last week: today is Evaluation Day.

"I've contacted Dr. Gao (高) about that patient. He already knows about the situation and said that points will not be deducted. You can ask him", I hear Dr. Sun explain. I note the frustration in her voice. She continues, explaining that the patient had been so difficult to manage, responsive at first but now, he's just not interested in his treatment anymore. There has been nothing she could say to him these past two months to motivate him to take his medication. Dr. Sun described her exasperation when explaining the situation to me later. How could they take points from her when she had tried everything? How could they expect her to ensure that every patient completes treatment when there are people like her patient who don't care if they recover or not? How was it fair for her to lose points, for her department to lose points, for the hospital to receive less funding, and for everyone's salary to be affected by one individual's decision that she has no power to change? She'd appealed to the patient; appealed to the patient's father; organised it so that they would be reimbursed every month for his treatment costs instead of the at the point of cure; made several home visits and sat with them, each time without a facemask so as not to upset the patient or make him feel stigmatised; offered words of encouragement, praise, and reminded him of reasons he had worth living for. She'd

worked so hard on the case but it had not resulted in treatment completion – what else could she have done to earn that point for the department?

Further adding to her frustrations was why she had to remind Dr. Fan (范) from the district CDC of her efforts that morning. Dr. Sun explained to me that she'd already spent a long time explaining the situation to Dr. Gao, who'd assured her that points would not be deducted. But she was worried about whether Dr. Fan would be as understanding and sign off on that lost point. And all of that was just for the management of one patient – one out of the one hundred she'd had to oversee this year. On top of that, she hadn't been able to deal with any of the reimbursement paperwork that week due to having to put together and print off the work-output handbooks for the evaluation. They comprised every PowerPoint presentation she'd given these in the past six months; corresponding photographs evidencing that this work was done; and records of every digital entry cross-checked with her physical files. It'd taken the whole week to put these books together. That meant that some patients would be delayed in receiving their reimbursement money. "And then", she said, "they ask you in the evaluations why patients received their reimbursements late – it's because of the evaluations!"

"You don't pay us enough for this! You are demanding too much!". Back to Evaluation Day. I turn to see Dr. Xu looking exasperated and speaking in a raised voice at the district CDC evaluator interrogating her work today. Dr. Xu has twenty-five years of experience and is usually generous and jovial, even when she's busy trying to manage hypertension and diabetes for the entire community.[83] Not today. She is flushed and defensive, and the evaluator trying to calm her down. The evaluator pats Dr. Xu's upper arm in a gesture of comfort. I later learned that Dr. Xu and the evaluator have worked together and known each other for years, and that it was because of their usually friendly interactions that the situation didn't escalate.

Then laughter cuts through the tense office atmosphere. It'd come from Dr. Feng's cubicle where she is standing and leaning on her elbow, which she rests on her evaluator's shoulder. The evaluator is sitting in front of the community doctor's computer, scrutinising her entries. Her face didn't seem pleased, and she suddenly becomes impatient and shrugs off Dr. Feng's elbow. Dr. Feng's face changes, with both of them now looking discontent, as the evaluator points to the screen. They

[83] These are two of the most prevalent health conditions in contemporary China whose epidemiological turn has seen more of the population dying from non-communicable diseases than communicable diseases since the onset of 'modern' lifestyles. Both hypertension and diabetes feature in the country's top ten causes of mortality (Hewa and Liu 2018).

discuss a little and both their faces relax again. Dr. Feng then takes up the evaluator's ponytail and starts to stroke it. The motion was indicative of the many years they have worked with each other and that they would work out how to smooth things over.

"Dr. Sun, can you photocopy these ten patient questionnaires in your work output handbook please? I need to bring them back." Dr. Sun recounted feeling a sudden flash of panic at that moment. She hadn't known that Dr. Fan would need to bring back questionnaires. Otherwise, she would have selected different ones, ones that would have represented her work better. She expressed as much to Dr. Fan, who reassured her that the ones she'd included in the thick work output handbooks were fine and that her points total would not be affected. I remember Dr. Sun still had a concerned look on her face as she made her way to the photocopier down the corridor.

On another occasion, I asked Dr. Sun what is the role of the CDC within the tuberculosis control programme. She answered, "to evaluate (考核; *kaohe*)".

Evaluation Day takes place biannually and is the occasion when public health professionals are assessed on their work performance for the previous six-month period. It takes place at each level of the tuberculosis control programme: district and municipal staff evaluate the performances of doctors working in the community; municipal personnel come to score their colleagues in the district offices; and representatives from the national CDC in Beijing visit their east coast counterparts to assess municipal-level efforts. Evaluations audit an individual, section or department by assessing whether or not they have enacted protocol and achieved indicator targets, as documented in work output handbooks. These artefacts are comprised of spreadsheets, PowerPoint presentations and pictures. They function as collated evidence for reporting 'up' that tuberculosis control has taken place. The finished product of the work-output handbook itself becomes the material manifestation of this official tuberculosis work, explaining why so much time, energy and anxiety are invested in its creation. "Audits are used to determine the quality of data" (Merry 2016, 11) and everything from how the books look (typed, printed and spiral-bound), its content (textual, numerical and visual), and its timely production is assessed to determine the quality of the health professionals' work performance. And yet, the above account informs that much more goes into the work of tuberculosis control

than documenting that Standard Operating Procedures (SOPs) have been followed. In the evaluation day scene above, this other labour is not numerically measured but is very much observable in multiple ways: Dr. Sun's frustration due to the *maodun* between the complexity of patient management and the binary nature of points scoring; the smoothing out that goes on between the auditors and auditees; and how evidence can be and is organised to convey a particular picture of public health.

This chapter seeks to bring this 'other' labour into better focus. Considered by health professionals to be fundamental to tuberculosis control work, I identify this effort as being emotional labour (Hochschild 1983) that compels thinking-with and acting-with care (de la Bellacasa 2012). Sociologist Arlie R. Hochschild describes emotional labour as the commodification of one's private emotion work into an occupational skill that is waged. This emotion work is trained throughout one's life, when one learns feeling rules that determine how one ought to behave outwardly and to what degree given a particular situation, regardless of how one may actually feel internally. Identifying and determining the correct form of expression is context-dependent and requires one's judgement and ability to manage one's own emotions and that of 'the room' and others within the space. Emotion work is therefore effortful, and emotional labour is the commodified, commercialised and waged recognition of this effort as being a part of the job. Hochschild defines three conditions for emotional work: first, it requires face-to-face or voice-to-voice contact; second, it requires the employee to produce an emotional state in another person; and third, it allows the employer, through training and supervision, to exercise a degree of control over the emotional activities of employees (Hochschild 1983, 147). Writing about the experience of air hostesses and tax collectors in the 1980s, Hochschild argued that emotional labour is largely carried out by women and taken for granted, thus rendering it functionally invisible. Applied to public health professionals, this chapter finds that this is, unfortunately, still the case for community doctors working in tuberculosis control in contemporary Shanghai.

This invisibility leads to a number of challenges for both health professionals and the tuberculosis control programme itself, with its effects being exacerbated by scale (see Chapter Six for more discussion on scale). When applied at scale, although the same amount of, if not more, emotional labour is necessary in order to get the job done and meet the demand, the focus continues to only remain on the measurable output. The extra emotional labour required to make these metrics is, at best, ignored or, at worst, denied, further entrenching this invisibility. Hochschild argues that the invisibility of emotional labour increasingly impacts on the individual's sense of self over time and leads to their alienation from their client (or patient, in this instance),

from their work, and, in extreme cases, from themselves (Hochschild 1983, 6). Another challenge incurred is the preclusion of emotional labour from any considerations of how tuberculosis control work functions and how it can be measured. This generates what anthropologist Sally Engle Merry has termed 'expertise inertia,

> Measurement generally builds on previous models and approaches, refining or expanding them or correcting their recognized problems. Adapting existing templates and forms of data analysis and presentation requires expert knowledge, producing what I call "expertise inertia." Expertise inertia means that insiders with skills and experience have a greater say in developing measurement systems than those without—a pattern that excludes the inexperienced and powerless. (Merry 2016, 6)

Community doctors are some of the lowest-paid health professionals, leading to many more women taking up and staying in the role,[84] with their voices and expertise being predominantly excluded from conversations on policy and programme design. Although district officers may relay some of the concerns community doctors have to those higher in the hierarchy, their emotional labour is less likely to be relayed due to its invisibility. Together with the data inertia discussed in Chapter Four, these chapters demonstrate how the technocratic practice of audit culture(s) (Shore and Wright 2015; A.B. Kipnis 2008; Strathern 2000a; Power 1997) create(s) a context in which relevant data and expertise are excluded from the process of indicator refinement that may be beneficial for Shanghai's tuberculosis control programme. This *maodun* confounds the purpose of DOTS and the efforts of health professionals.

This chapter is, therefore, further concerned with how audit culture(s) obfuscate(s) emotional labour whilst simultaneously demanding it. The first section looks again through the lens of the financial and explores the task of managing patient reimbursement files as carried out by community doctor Dr. Sun. She is an individual who goes above and beyond protocol to assist her patients although this work is not acknowledged. She carries out this emotional labour because she regards it as being fundamental to assisting her patients' recovery. The importance of this labour is common knowledge amongst community doctors and some cohorts hold their own trainings to share their experiences of how to best express care. It is the exchange and recognition of this care that forges relationships of trust between the community doctor and patient, with this trust being crucial for treatment adherence and scoring points on Evaluation Day. The section further draws on anthropological writing that cautions against assuming an idealised concept of care. "Care eschews

[84] Men are traditionally expected to bear (more of) the financial burden of the family. Some male community doctors I encountered also worked a second job informally to make up for the low wage they earned as a public health professional. Moreover, offices at every level of the tuberculosis control programme were predominantly occupied by women.

easy categorization" (de la Bellacasa 2011, 100). It can be defined as being beneficial or controlling, supportive or suffocating, depending on the context.

The second section explores this obfuscation further. It discusses audit culture(s) that exacerbate the optics of tuberculosis control and entrench the invisibility of emotional labour. Drs. Tian and Hu struggle to make sense of the dogged pursuit of numerical targets given the lived realities of patients they encounter through their everyday work. This tyranny of transparency (Strathern 2000b), based on numbers and statistics, stakes its claims in the universal, objective and impartial measurement of treatment and care. However, as anthropologists Miriam Ticktin and James Ferguson have shown, 'regimes of care' can incorporate surveillance and policing that simultaneously produce unintended effects – what Ticktin (2011) has called 'armed love' and Ferguson (1994) has coined an 'anti-politics'. In the case of Shanghai's enactment of DOTS, the programme's technocratic approach instates it as the data- and expert-driven – and therefore impartial and professional – management of patients' recovery from tuberculosis infection. This is done through an insistence on limiting categories and metric fixation (Muller 2018) enabled through a denial of socio-economic and political context (as explored in the previous chapter) that simultaneously ends up producing and reproducing the conditions that obstruct patients' ability to adhere to treatment in place of facilitating it, however. This anti-politics of care (Ticktin 2011), this apoliticisation of intervention (T. Li 2007; Ferguson 1994), is what compels (some) community doctors' exertion of emotional labour, and is what Drs. Tian and Hu struggle to make sense of given their positions at the interstice of policy and practice. The section examines the actions health professionals are compelled to take when confronted with these circumstances in relation to the production of metrics and data. It does so by considering emotional labour as incorporating affective performances (D. Wu 2021) that are still relevant within state institutions such as the SCDC.

The final section situates the emotional labour and care enacted by community doctors in their social, political and economic context to further understand the significance of these acts. It is Dr. Shan's (鄯) opinion that "we don't have enough people doing patient management in tuberculosis". This section examines the wider issues at stake for why this is the case.

ACCOUNTING FOR CARE IN THE COMMUNITY

I look to the cubicle on my right and see Dr. Sun engrossed in her ledger, keeping place with a ruler and her pen as she moves down the page. A pile of receipts awaiting her attention is positioned to hand on her right. She is updating her patient reimbursement files. As the only community doctor for tuberculosis in the area, she is responsible for managing the treatment of, on average, ninety to over one hundred new patients every year. This figure does not include the patients who did not complete their treatment the previous year, whom she continues to manage for as long as is necessary. She is stationed in Qingnan community health clinic (清南社区服务卫生中心) in the Pudong New Area district.[85] Her high caseload reflects the high numbers of the floating population living in this area; located outside of downtown, the rent here is lower and it is conveniently connected by a direct metro line. Dr. Sun keeps the reimbursement accounts for all of her one-hundred-plus patients, with these records being evaluated biannually.

From our first meeting, I found Dr. Sun to be polite and professional, and she gave me the sense that I could trust her. Since then, she's been genuinely concerned that I learn about how tuberculosis control is carried out in the community. She has been welcoming and inclusive, and has continued to demonstrate her care for me and my research with her patient explanations of her work; by how she searches for other ways to explain if I don't immediately understand; she allowed me to accompany her on patient home visits; introduced me to other doctors and departments I wanted to meet and observe; given me material I might find interesting and useful; offered me lifts in her car to the metro station as it's a far walk; tried to arrange for me to attend any event I've been curious about; and offered me recommendations for TV programmes to watch on Shanghai's healthcare system. She has given me much more than just a run-through of the SOPs and the recorded facts and figures. I have observed over time how she does similarly for her patients. She takes the time to engage with them, sometimes sitting with them for long periods, to listen and respond to their questions. Although this takes time away from the other tasks she has pending, she exerts this emotional labour as she sees it as a necessary part of her job. Her actions convey a sense of care and concern for their well-being and recovery that is felt in the room. Her emotional labour extends to her speaking with me about the importance of financial support for patients and her concern that what is reimbursed is not enough. Dr. Sun explains that,

[85] Pseudonym used.

The Global Fund previously funded an allowance for MDR-TB patients. Every month they'd receive RMB 230 for food and travel. It was for floating population patients only, not those with a Shanghainese *hukou*. It was easier to manage patients with that allowance. Because think about it, people can't work after diagnosis, and having that allowance enables patients to feel that this policy is actually quite good. And that encourages adherence and cooperation. This is because some patients are really so poor.

I had a patient, so poor. Every month his rented room is RMB 500 for just 1 room. No bathroom, no kitchen, just a bed. He lives there alone. He delivers *kuaidi* [快递; fast deliveries]. He's from a poor province, Guizhou, and works in Shanghai to send remittances to his family in his hometown. After he was diagnosed with tuberculosis, his wife left him and their child. So he has no choice but to work, but I told him that he can't allow himself to get too tired, because you know *kuaidi* work is hard. He earns RMB 2,000 per month, most of which he sends home for his parents and to care for his son. After that, there's the rent. When it comes time to go to the hospital, he has no money. But he wants to get better, he wants to take his medications, but he has no money. What could he do? So he asked me, and every time, he gives me an IOU slip. Each time he borrows RMB 400.

I said it's no problem, you can come here and I'll forward you some money. There's no other option [没办法; *meibanfa*]. I can take it out of his reimbursement when the time comes. But I feel like it doesn't matter if I get reimbursed or not. Even if I just give it to him, I'm fine with that. He's really so poor. The clinical doctor, they haven't spoken with him, they haven't seen how he lives and what he's dealing with, they don't understand his circumstances. I visited him in the room he rents and saw it all. This kind of patient, he is the head of the household, if you don't help him get better, how can he support his family?

Dr. Sun has undoubtedly gone above and beyond for her patient. She has used considerable discretion (Lipsky 1980) to enable this patient to continue their treatment. She is aware that he is engaged in employment, although it is forbidden for a diagnosed tuberculosis patient to do so as per the contract signed at the beginning of treatment. Most strikingly, her emotional labour compels her to lend her patient money in order to enable him to sustain his recovery. She does not do this for all of her patients, but she extends extra care for this individual because she understands

and has personally seen the challenging circumstances with which he is struggling. Knowing and having seen them for herself, she feels that there is no other option but to support him in this way if she is to do her job and help him progress towards recovery.

The patient has MDR-TB, which makes his treatment considerably longer, costlier and more complex. Such patients are reimbursed monthly instead of at the point of cure so Dr. Sun will receive some reimbursement. However, officially, Dr. Sun has gone beyond the call of protocol and her extra efforts – her emotional labour enacted as empathy and the provision of financial support to her patient – would be considered 'unnecessary'. In a follow-up interview, I was told by Dr. Wei (魏), a municipal officer, that the patient's financial difficulties were not of Dr. Sun's concern and that the patient could have investigated other forms of state support to finance his treatment. There are no other forms available to someone with a non-local *hukou*, which is why Dr. Sun exercised the discretion she did. The officer then agreed that if socio-economic and financial difficulties are what deter patients from finishing treatment, then more support should be provided by policy rather than individual doctors having to put their hands in their pockets. As he put it, "how many patients can a doctor help in that way?"

Concomitantly, Dr. Sun's actions ensure that her patient conforms to his drug regimen and treatment schedule. In doing so, she is engaging in a form of self-care (Leeshafft 2017) as her actions also ensure that she makes the metrics demanded of her and that she does not lose points for a patient not adhering to treatment. Community doctors, in fact, *need* their patients' cooperation and compliance in order to score the points required to secure their own salaries, maintain their hospital's work performance rating, which impacts funding, as well as to fulfil their professional roles and sustain collective *guanxi* (关系; Chinese term for social networks of influential relationships). The financial fates of patients and health professionals are bound together through the practice of audit culture(s).

This example of Dr. Sun's use of discretion to care for her patient throws up considerations of "good invisibility" and "bad invisibility" (Star and Strauss 1999, 24). Sociologists Susan Leigh Star and Anselm Strauss write that,

> the relation between invisible and visible work is a complex matrix. It is relational, that is, there is no absolute visibility, and illuminating one corner may throw another into darkness (Ibid.)

In this instance, it was the invisibility of emotional labour that allowed Dr. Sun to financially support her patient. With more visibility comes more surveillance, and the tyranny of transparency (Strathern 2000b) can put up roadblocks instead of assisting flow. For her efforts, Dr. Sun will not receive any recognition for the lengths she went above and beyond to assist her patient, literally at her own expense. However, if she did not lend her patient the money to attend his hospital appointment and buy medications, she would be *deducted* points for *following* protocol. In this instance, governance by numbers and audits means that Dr. Sun would be *penalised* for doing what she felt was necessary in order to *assist the recovery* of a vulnerable patient in circumstances she considered *meibanfa*. In contradistinction, she would also have been *penalised* for *following* protocol and not assisting her patient as that would leave him unable to continue his treatment and she would *lose* points. She would, however, be considered correct for following protocol by not assisting him personally but would still be penalised points-wise. Incredibly, it seems that going beyond protocol and lending her patient money was the only way to care for both her patient's continued recovery and her own financial security. The ritual of verification (Power 1997) that is the practice of audit culture(s) shows up its 'perverse effects' (Shore and Wright 2015) that "fail to deliver what it promises and…may result in decision making that is amoral or outcomes that are immoral" (Ibid., 426), usually in the name of efficiency. This significant *maodun* renders the principle of 'patient-centred care' lost when it comes to evaluating health professionals' work performance.

Dr. Sun continues,

> I feel that for patients like this, we need for them to receive more financial support. And even the reimbursement, it's not that everything is reimbursed. It's actually only a very small portion. If you are admitted to the Shanghai Pulmonary Hospital [SPH],[86] it costs at least RMB 1,000 per day. Just for renting the bed itself. But at least if the patient stays in the SPH you can reimburse some of it, as not all hospitals permit reimbursement. As long as you're admitted into hospital, they will assess you head to toe, it doesn't matter if you need that examination to confirm an illness or not, they will still do it. If you don't want it, you still have to have it! […]

[86] The main third-tier pulmonary hospital for treating tuberculosis in Shanghai and second in the country (as mentioned in Chapter One).

> This is a receipt for Pudong Pulmonary Hospital (PPH),[87] they are comparatively cheaper. Look, the total is RMB 5,000 plus. Just a few items and it's over RMB 5,000. This patient was admitted at the point of diagnosis. I can only reimburse him RMB 500. This is considered quite a lot, I've put him down for high amounts. The rest of the costs are not eligible. [...]
>
> For prescriptions, in 1 go, I can only reimburse RMB 800 for the 4 drugs. Liver protection drugs, they can't be reimbursed because this patient is not over sixty years old. This is a young person, just graduated from university. And even if I could reimburse them, they total RMB 300 each time but only RMB 100 can be reimbursed. Our patients really have very, very heavy medical expenses. And I really cannot reimburse them very much. [...]

Dr. Sun wishes here to convey how *little* the patient is reimbursed and that extra financial support for patients is necessary. This is interesting in contrast to the previous chapter, which outlined how the municipal auditor and district auditees spoke mostly of how *much* patients are reimbursed. In contrast, Dr. Sun is focused on how much patients don't receive in financial support and how little they do receive when they are compensated. This may seem like a small detail but it is a fundamental difference in how patient management is approached as one ascends the hierarchy (see the next chapter for more on how perspective and approach are affected by scale). Dr. Sun holds this perspective because she is in direct contact with patients and confronted with the real conditions in which they live. The district and municipal personnel are not in direct contact with patients and only know them by numbers – their patient number; their compliance scoring; and how much they will be/have been reimbursed. There are, in fact, two scales at work here that obfuscate emotional labour and render it invisible – one in terms of the increasing numbers of patients, and the other in terms of the hierarchy of management. Both together comprise the practice of audit culture(s) that, with its focus on the numerical, enable patient cases to be made commeasurable by stripping away history, context and circumstances (Merry 2016). Dr. Sun is privy to the details, however, and even though she has over one hundred patients, she chooses to exert emotional labour and makes sure to put her patients down for all the items they are eligible for and for "high amounts".

> With regard to my work, the policy right now is to intensify [强化剂; *qianghuaji*] follow-up. This means meeting with patients to follow-up on their situation

[87] The second pulmonary hospital for treating tuberculosis in Shanghai. It is a second-tier hospital with more basic facilities than the SPH.

every two weeks until they are cured. They also want us to go to their homes very month but I can't achieve this. I have over one hundred patients every year. Some of them don't want me to go to their home as they may be working or because of stigma. I don't have enough time and I have so much other work to do. If I had ten patients I could do it, but not over one hundred. Think about it: if I were to spend every single day doing only that task, driving my own car [with no fuel allowance] because Qingnan is very big – some patients may be one or even two hours drive from here – I still couldn't achieve that. Even if I try to get to three or four patients per day, I still might not be able to get to them all. And this in addition to my other duties in tuberculosis control and diabetes. So that's how important that first meeting is. If that first meeting goes well, then it's not tiring to manage the patient afterwards. They will cooperate and definitely keep to their treatment.

A feature of the Shanghainese programme is that it is not actually DOTS. That is to say, it's not directly-observed therapy by health professionals but rather family member-administered or self-administered therapy (SAT).[88] This is due to there being a huge volume of patients and not enough health professionals, as well as it not being practical for patients to come to clinic multiple times per day for their medication, nor vice versa for health professionals to visit patients at home multiple times a day to directly observe them swallowing pills (see Chapter One for the historical development of DOTS in China). The metropolis of Shanghai is spread out across over 6,000 km^2 but even a community like Qingnan may take two hours to cross by car in addition to there being a high concentration of patients.

For this reason, Dr. Sun speaks at length about how crucial the 'first meeting' is for successful patient management. This is the occasion when patients and community doctors meet in person for the first time and Dr. Sun makes sure to spend at least one hour engaging with her patient and their family member(s). Having bore witness to these occasions, I can say that she conducts these meetings in a warm manner with generous doses of practical advice to answer questions and allay concerns. This included how to take the medication,[89] lifestyle changes, and what

[88] The necessity of having another administer treatment for the patient, and only resorting to allowing the patient to self-administer if there is no other option, is indicative of the bias intrinsic to the design of DOTS that patients are unreliable, irresponsible and unpredictable. This is why they need another to manage their treatment. There are parallels to be drawn here with the logics of audit culture.

[89] For example, rifampicin must be taken before food and not with dairy. Failure to do so will affect the body's absorption of the drug and the outcome of the treatment. Clinical doctors receive so many patients that they may not have time to explain these details to the patient. The community doctor is often the only person to relay this important information to them and, crucially, take the time to ensure that the patient understands why.

foods to eat and avoid. This latter aspect was heavily based in the principles of Traditional Chinese Medicine (TCM), which the patients themselves were sometimes already be familiar with.[90] This recognition often prompted the patient or the patient's family member to engage more with what Dr. Sun was advising. I understood this as their becoming more engaged with managing their own or their family member's recovery as they discussed the patient's condition in familiar terms. This interest shown by the patient and/or family member would spark more enthusiasm from Dr. Sun.

Finally, Dr. Sun would always offer her personal mobile phone number and WeChat contact to every patient,[91] telling them that they could be in touch with any questions. Patients and family members always accepted her contact details gratefully as not everyone has direct access to a doctor. And many of her patients took her up on her offer. Dr. Sun recounts that one patient rang her at 11.30 pm at night to anxiously seek her advice regarding his pregnant wife. Another patient had decided to return to her hometown in Yunnan province for treatment but found that she had no medical support there and would regularly text message Dr. Sun in Shanghai with questions regarding tuberculosis and her treatment. That her patients felt able to contact her even when they had questions unrelated to tuberculosis or if they were not technically her patient signified to Dr. Sun that she had been successful in forging a relationship of trust with them through her multiple demonstrations of care during their first meeting, and that these relationships were sustained by the consistency of her emotional labour afterwards. For Dr. Sun, she explained that she understands that her patients may be unable to ask their clinical doctor or anyone else such questions, and that it is a small thing for her to respond.

The importance of the first contact meeting is common knowledge amongst community doctors. It is known to be a crucial aspect of patient management, so much so that the district personnel arranged a special training session run by community doctors to share their experiences of the first contact meeting with each other and how to best manage it. As we saw in Dr. Qin's presentation in the previous chapter, timely first-contact meeting is measured by an indicator. That indicator measures whether the event took place on time and, implicitly, whether it took place

[90] There is a part of TCM therapeutics that is common knowledge of which most people possess some awareness and that is spoken about in common everyday discourse. This knowledge is part of 'nourishing life' or *yang sheng* (养生) practices that the public more popularly engage in in response to the rising price of healthcare and the increasingly pressurised health system (for more on this discussion see e.g., Farquhar and Zhang 2012)

[91] WeChat is the main social media messaging application used ubiquitously in China.

at all. There are no official indicators that (ac)count for what these community doctors find to be so crucial for patient management that they organised this event. The speakers mentioned how to prepare for the meeting and what information ought to be disseminated, such as how to correctly take the medications. The main focus, however, was raising awareness of the various issues that patients worry about, as gleaned from community doctors' direct experience, and how to respond to their anxieties and concerns. There was a notable emphasis on emotions and empathy throughout the session, even advice to speak slowly so as to give the patient time to absorb all the information, and gently so as not to cause them alarm. This was essentially a training session on feeling rules for caring for patients' treatment concerns and building a relationship of trust. It was set up by the district CDC staff but run by community doctors for community doctors. The district CDC colleagues were aware of the importance of this first meeting from working directly with their community doctors. The generation of expertise inertia meant that it was not protocol across all districts, however.

Common patient concerns included whether the doctor had misdiagnosed them and the patient wanting to discontinue treatment; suspicion that the doctor is making money from drug sales and wanting to discontinue treatment; how their illness will affect their family members if there are elderly or children in the home; what the neighbours will think and say if they see a doctor coming to the door; whether the treatment will affect their work or studies; what to do if they don't have time to visit the doctor due to work; if the disease and drugs will affect their relationships or marriage and will it harm their partner; economic worries were common, especially for recent graduates with no job; and how to manage adverse drug reactions and side effects, amongst others. The community doctors advised each other on how to best tackle these concerns that span the spectrum and reassure their patients. In doing so, community doctors advised each other to take a 'family' approach, meaning one of close familiarity, trust and care.

> When we talk to the patient, we should pay attention to how we speak to them. We should speak at a moderate pace, not too fast, and our attitude should be kind. The tone should be gentle, and there should be a way to slowly rebound. Like in the context of a family. It's all through a family bond. In this way, we should observe the patient's tone and attitude during the conversation and adapt our own language to them. For those patients who are very upset, we should comfort them first. We can't force them. This kind of patient may become directly defiant if you badger them. So instead, we have to firstly listen to their complaints. After they have expressed themselves, we can slowly go

> through and address each concern one by one. Explain to them one by one. The patient may then slowly accept some of your explanations, maybe not all of them, but importantly, you took the time to listen to them. (Speaker Two)

There was a special note made to "try our best" (Ibid.) to assist patients with economic problems if possible. This was left open and unspecified, but nods around the room indicated that it was understood. Finally, on the topic of elderly patients,

> They will talk to you a lot, and they will talk to you like family. I listen carefully first, and then I insert some of the treatment knowledge I want to tell them. They will be very happy for you to come. They are happy because they feel that someone cares about them. (Ibid.)

The exertion of emotional labour to manage their patients' emotions and reassure them that "someone cares" is a crucial aspect of these health professionals' work. Their doing so demonstrates incidences of thinking and acting with care (e.g., de la Bellacasa 2017, 2012; Mol 2008). Almost every community doctor I worked with spoke at length about how crucial it was that patients felt cared for (*guanxin ta*; 关心他) and that it is from this emotional labour that the management (*guanli*; 管理) of patients is made possible. Some community doctors also spoke of how it is the therapeutic qualities of care that give their work 'purpose'; i.e., the assistance of patients in their recovery from illness. Concomitantly, enacting this purpose means that community doctors are caring for themselves (Leeshafft 2017) by making efforts to ensure that they attain the metrics and points necessary to receive a full salary, and that they fulfil their part in the collective work of maintaining departmental funding. (Invisible) emotional labour induces these forms of care that enable tuberculosis control work. As put by anthropologist María Puig de la Bellacasa,

> caring is not an option but a vital necessity in our technoscientific world, and nothing holds together in a liveable way without caring relationships. (de la Bellacasa 2011, 100)

However, she and other anthropologists have also cautioned against an idealised notion of care and instead explored its non-normative qualities – qualities that cultivate non-normative epistemologies and non-normative ethics (de la Bellacasa 2012). De la Bellacasa notes that,

> the term *accurate* derives from care: 'prepared with care; exact'; it is the past participle of *accurare* 'take care of'. Here, the notion of doing something with care led to that of 'being exact'. The tempting proximity between these terms reveals risky

> ground: the ambition to control and judge what/who/how we care for. (Ibid., 211; author's italics)

The inherent ambivalence, malleability and even interpretability of care require it to be known in context. Whether it can be determined as being helpful, intrusive, supportive or suffocating comes from experiencing it with all the details. It is a situated knowledge (Haraway 1988) made through the relations of relations, and its significance lies in the eye of the beholder. Zhu et al. (2018) have examined the concept of care in the context of the new mental health law in Shanghai. They write of how *guan* (关; care) can be experienced as either care and/or control, as protection and/or as a discipling agent through the construction of the family as a moral subject by the state. Zhang and Song (2020) have explored the multiple ways through which *guanai* (关爱; care and love), a government approach for rehabilitating drug users, is co-opted and utilised in different ways by the various stakeholders who engage with this social welfare policy for their own ends. The exactness enacted by the technocratic practice of audit culture(s) in DOTS can be interpreted as a form of care that strives to ensure that all patients receive the same treatment. However, it is the insistence on 'exactness' and 'sameness' through numbers that can inflict 'bureaucratic violence' (Qureshi 2022) on patients and health professionals. This violence insists and imposes that all patients are the same through the use of numbers and statistics that strip away history, context and circumstance. These details, these matters of care (de la Bellacasa 2011), are then buried and kept from the light of (evaluation) day despite being lived in the quotidian – the resultant effects of data and expertise inertia.

'SERVE THE METRICS'

The exactness of audit culture(s) can unsettle even the staunchest believer in a purpose of care-to-help-cure, however. Dr. Tian (田) shared with me the reason why she chose to work in public health. Energetic, welcoming and with a sunny disposition, by the time we met she'd already worked as a tuberculosis community doctor for seven years. She'd initially worked in paediatric vaccinations in the primary health clinic before later being moved to the preventative health department to manage tuberculosis patients. Dr. Tian described public health work as being 'meaningful' (有意思; *you yisi*). She explained that she chose to work in this field because if she and her work could help someone get better, then that gives her

actions positive purpose. Interestingly, Dr. Tian expressed surprise that someone would do this kind of work for any other reason.

> The country [government] would not tell us to do things unless they are worth doing. They have their reasons for what they tell us to do, and so it is always meaningful. You can't just do things for yourself and not for society. You have to think of wider society in the things that you do.

Having staunchly stated the above with conviction, Dr. Tian's next remarks voiced ambivalence, however.

> On the theme of meaning, sometimes I really can't understand why the country [government] tells us to do what they do. Sometimes it is really difficult, and they set these figures and expectations that are unrealistic and give us so much pressure. Sometimes some of things they want us to do really waste time and money, and I can't make sense of it. They sit at the top and they never come to see what the reality is. They don't know how things are. They sit at the top and think of these plans and figures that may sound great, but they are so hard, almost impossible to achieve. They never come to the ground, and they never ask us.
>
> For example, it is not realistic that they ask us to treat every patient in the same way: they should finish their treatment at a certain time or else. But every patient is different. Patients need different amounts of times to get better. They live and recover under different circumstances.

Perhaps Dr. Tian reconciles the ambivalence caused by the *maodun* she describes by use of the adjective 'sometimes'. Perhaps 'sometimes' allows meaningfulness to be at once both intrinsic to and absent from state mandates. Perhaps because these *maodun* only happen 'sometimes', this allows Dr. Tian to carry on with her work the rest of the time; to continue engaging in care for her patients despite being unable to makes sense of many of the demands made of her. Such demands include achieving 90% treatment adherence when, as concluded by Dr. Tian after seven years of experience, "every patient is different" and requires their own amount of time to recover due to the different lived realities they may be negotiating. The focus on numbers strips away the details of these realities and thus easily justifies punishment for not making the metrics. Some of the targets are described as being "almost impossible" to fulfil. In contrast, points are not awarded for the emotional labour and care she exerts and gives to her patients despite these aspects being

crucial to their recovery. The privileging of those at the "top" to decide plans and figures means that those in the community 'below' are excluded from the conversation. Nor are they asked. Here, we have expertise inertia in the making.

Scholars examining audit culture in the U.S. and the U.K. have written of the effects it has on those subject to this neoliberal form of governance. Scholar-accountant Michael Power (1997) has highlighted how this practice to promote accountability actually increases mistrust within workplaces. Anthropologist Marilyn Strathern (2000a, 2000b) has examined how audits and indicators induce opacity in place of promised transparency. Merry has expounded on the technocratic form of "new governance" it enables (2016, 10). Individuals transform from people into "auditable' entities" (Shore and Wright 2015, 423) whose performances are evaluated by how well they measure what counts. Finally, audit culture operates across scales, with the state's dictates being enforced on all levels. Its effects are therefore totalising and ensure obedience and conformity to a narrow form of knowledge production and power according to a rationality based on modern financial accounting. The individual is made responsible for their own financial and occupational fates. If you don't make the metrics, then you have no one to blame but yourself. Subjects are "named and shamed" (Ibid., 425) on league tables to do better. Within this practice, care is (dis)placed onto the metrics, to hitting targets, and achieving indicators in lieu of patient-centred care, equity for employees, or even to ensure transparency.

Anthropologist Andrew Kipnis has critiqued this singular reading of audit culture as a form of neoliberalist governmentality of western making with global reach (2008). He has instead called for the conceptualisation of audit cultures*,* arguing that excessive focus has been placed on the seemingly totalising and unstoppable force of neoliberalism in analyses of the practice. Rather, he uses ethnographic examples from China and the Chinese diaspora in the U.S. to demonstrate the Confucian and socialist bases of governance through numbers. Moreover, he states that this singular focus "masks more than it illuminate[s]" (Ibid., 280) and that, in fact, critiques of scientism rather than of neoliberalism would be more useful for understanding what is at work in the numerical managing and measuring of work performance. In his article, Kipnis specifically critiques sociologist Nikolas Rose's definition of neoliberalism due to its popularity and widespread use amongst social scientists (including those cited above), so much so that many of Rose's 'assumptions' have become tacitly accepted and incorporated by governmentality theorists (Ibid., 277). Kipnis identifies neoliberalism as meaning two things, according to Rose:

> the desire to govern by encouraging individuals to become more responsible and enterprising, to revive their sense of responsibility…to produce governable, industrious, and responsible individuals by engineering their souls, and the desire to 'govern from a distance'. (Ibid., 279)

Rather than for the purpose of engineering enterprising individuals, Kipnis uses ethnography and the writings of another Chinese scholar, sociologist Zhao Shukai (赵树凯), to demonstrate that "evaluation by examination" (Ibid., 276) is a method with a legacy of use by the Chinese Communist Party (CCP) and based in socialist and Confucianist logics. Teachers, cadres and civil servants (recalling that doctors are classed as civil servants in China) are tasked with providing the government with the metrics it mandates for furthering the country's development. These targets are almost always in numerical form as per the CCP's use of science and scientific management to improve the *suzhi* (素质) or 'human quality' of people as part of its national project (e.g., Greenhalgh 2010). To fail to do so is to be someone who let the national socialist project down, and according to Confucianist rules, it is to fail your fellow colleagues, *danwei* and the wider country to which you are connected through the communist cause. This being unacceptable, and compounded by the weight of a hierarchical system and collective *guanxi*, numbers and statistics may be falsified in order to make the metrics (e.g., E.L. Fan 2016) and sustain the image of the socialist project (e.g., Ghosh 2020; Gross 2016; A.B. Kipnis 2008). Scholars who write of the neoliberal agenda in audit cultures also report data falsification or the 'tweaking' of statistics as one of the effects of metric fixation, where care is (dis)placed onto the numbers. Importantly, Kipnis' argument contends that people may exhibit the similar behaviours and ways of coping with audit cultures and its effects, but the local, historical and contextual factors matter and are not merely whitewashed by an all-encompassing neoliberalism. He argues, therefore, that instead of focusing solely on the political, a critique of how scientific reasoning is co-opted to support and verify political agendas, either in China or the 'West', may be more fruitful (see the next chapter for more discussion on how numbers are used to bolster wider narratives fostered by China and global health institutions).

Dr. Hu (胡), a community doctor not working in tuberculosis, spoke candidly about his experience of constant evaluation by examination in contemporary public health work.

> I feel that those at the top, like in the CDC or the Health Commission, I feel that they pursue [追求; *zhuiqiu*] the quotas and targets [指标; *zhibiao*] too much in

> the assignments they send us and don't attend to quality [质量; *zhiliang*]. Often, the targets that they want are too big and we have no way to achieve them so then we have to falsify them. I feel that this is a widespread [普遍; *pubian*] problem [...] As in, too excessively [过于; *guoyu*] pursuing the overly superficial [表面; *biaomian*] aspects. The bureaucracy, it's just looking at the outside. As long it looks good on the outside then the content is not important [...]
>
> Part of the problem is that the CDC order us to carry out assignments without caring what the reality or situation is for you. They just say, "you need to give me however many numbers". They give you a number and you have to achieve it. Then you report it up and they report it up, but they won't attend to whether or not you really did it or if it's actually done [事实; *shisi*]. It's not because it aids people's health, it's just because they want the quota target.
>
> There may be various reasons. The targets are too excessive because they haven't come here to see the actual situation, to see if we can achieve such a figure [...] But there's reasons on both sides. It could also be the doctors, that we're sitting too comfortably in the office and don't want to move. That's also possible. It's not just them.

Dr. Hu's insights make an important commentary on the power of optics. I do not evoke this term in relation to Foucault's work on the panopticon and the internalisation of self-governance (Foucault 1995[1977]). Rather, it is in reference to the concern with the *biaomian* that Dr. Hu describes that compels a pervasive preoccupation with quotas and targets. The Chinese character *biao* (表) means external or surface, and the character *mian* (面) refers to face or side. Ensuring that the *biaomian* of quotas and targets is maintained ensures that the *mianzi* (面子; face; e.g., A. Kipnis 1995) of all those associated with the work is upheld. Those higher up in the hierarchy define particular project quotas and targets as being indicative of epidemiological control and professionalism in terms of scientific proficiency. As expounded by Kipnis (2008), these data serve to bolster the country's technocratic claims to development and progress through scientific expertise and skill divorced from bourgeois liberality (see also Andreas 2009). As long as these numbers are achieved then on the *biaomian*, the national project is at work and underway. Failure at this task is therefore unacceptable when the status of the nation, as well as the community health clinic's position on the league table, is in the balance. This also

makes the *biaomian* painted by quotas and targets a preoccupation for those who are made responsible for collecting the numbers. The *biaomian* is, therefore, a space of engagement, where representation, communication and exchange take place. However, with all the optics focused on the *biaomian*, there is no need to penetrate down to local conditions when the use of neutral and objective numbers and statistics enables commensurability across conditions. Historian Arunabh Ghosh's work describes how the preoccupation with statistics in the early Maoist period resulted in "the primary objects of knowledge of the Chinese socialist state…[being] its own actions and their consequences" (2020, 285). Kipnis describes this as "a 'tail that wags the dog' of organizational goals" (2008, 282). Indeed, the same is being argued by this chapter and the scholars it cites who have conducted work in China, the U.K., the U.S. Dr. Hu's insights are a commentary on the technocratic power of optics to focus on the *biaomian*, to exclusion of other sights, vis-à-vis the justification of scientism as upheld by numbers.

Dr. Hu refers indirectly to the affective effects this practice of audit culture has on him and others in his position more widely. The emotional labour he exerts is considerable, not in this instance to care for his patients but, instead, to care about the metrics. The pressure to achieve is so great that he speaks about the widespread phenomenon of falsifying results – a measure that is taken when there is *meibanfa*. This act is reminiscent of the extent that Dr. Sun went to aid her patient's recovery and maintain her own financial security. Whereas in Dr. Sun's case it was to assist her patient whose economic circumstances were *meibanfa*, Dr. Hu describes circumstances in which there is *meibanfa* to make metrics that are "almost impossible" and "too excessive".[92]

Kipnis writes that,

> Technologies of governing do not diffuse only because they are forced down the throats of indigenous actors by powerful Western governing agents, although this sometimes may be the case. Rather, they often serve some sort of purpose in the management of social relations in a local context. In other words, they are seen as having the capacity to function socially for those locally positioned social actors who "see like governing agents." (A.B. Kipnis 2008, 286)

The work of anthropologist Di Wu (2021) offers some insight into how the practice of audit culture may function socially in the local setting for those who 'see like

[92] *Meibanfa* has been written about by professor of law Benjamin Van Rooij in collaboration (van Rooij et al. 2012, 2014) and by anthropologist Anna Lora-Wainwright (Lora-Wainwright 2021). Their work discusses ways in which there is an acquiescing and an activism in accepting the impossibility of a situation or social phenomenon.

governing agents'. He broadens out Hochschild's definition of emotional labour to incorporate types of affective performances that are demanded as part of the job. This emotional labour is certainly taken for granted, expected and unwaged. It is based in what can be considered 'traditional' ways of conducting work relations although degrees of these dynamics are still in practice in contemporary Shanghai, particularly in a state institution such as the SCDC. Wu writes of the working relationships between Chinese workers and their leaders (to be understood as bosses or managers; 领导; *lingdao*). In this dyad, Chinese leaders don't only demand that the work be done, but that it should be done with the correct affective performance (表现; *biaoxian*). The worker's attentiveness should be turned upwards towards those higher on the hierarchy. It is not enough to simply carry out the job but a worker should endeavour to please their leader by attending to their comfort and facilitating their ease.

> employees who are unfailingly helpful, cooperative, and courteous in dealing with their supervisors make a more favourable impression on them, and tend to receive better evaluations" (Ibid., Ch. 3)

This attentiveness is noted for intangible gifts later, such as promotions. Failure to carry out this attentiveness impacts leader's evaluations of their workers, which are couched in the leader's "flexibility, discretion and subjectivity" (Ibid.). Importantly, a cardinal rule is to not give your leader extra work/trouble. For this, workers are expected to be self-disciplined (自律; *zilü*) and independent (自理; *zili*), with the ability to find the solution to issues themselves.

Shanghai has a reputation for conducting itself less through 'traditional' norms and boasting more though 'modern' efficiency (see Chapter One). Nonetheless, the consideration of an emotional labour that incorporates affective performances enables the significance behind moments like Dr. Feng's stroking of her auditor's ponytail on evaluation day – the (re)performance and reinforcement of affective and hierarchical working relationships – to come into focus. In describing their role, I have often heard health professionals utter the statement 'serve the residents' (为居民服务; *weijuminfuwu*), through which they evoke the Maoist slogan and CCP motto 'serve the people' (为人民服务; *weirenminfuwu*) still in use today. Going to extreme lengths to 'serve the leader' or even 'serve the metrics' can be better understood when technocratic governance through audit cultures is examined within its local context.

"WE DON'T HAVE ENOUGH PEOPLE MANAGING PATIENTS IN TUBERCULOSIS"

Dr. Shan's statement not only communicates that there is a deficit of health professionals working in patient management. She is also saying that there aren't enough health professionals working in tuberculosis generally, and making a wider comment on the social, political and economic context in which medicine, public health and health professionals are extant in contemporary China. I commonly heard comments such as 'no one wants to work in tuberculosis', 'we [the tuberculosis division] get the leftover rubbish', and 'people don't stay long working in tuberculosis'. Notably, these statements were made unequivocally by health professionals who I had observed as being dedicated to their job, who spoke of meaningfulness and purpose like Dr. Tian, and who had already worked for a period of time in tuberculosis control. They were not individuals who disliked their job but these statements indicate other emotions they harboured with regard to their work. Not only do health professionals complain of the low salaries and high risk of infection in tuberculosis work,[93] but they believe that a career in healthcare today is too difficult and would not allow their child to go into medicine. Moreover, working in an aversive environment may exacerbate the alienation health professionals experience as a side effect of their exertion of emotional labour.

The following will first introduce the concept of alienation as posited by Hochschild. It will then sketch out the contemporary landscape of public healthcare in China to afford greater significance to health professionals' efforts to care. In doing so, it concomitantly elucidates the effects of alienation vis-à-vis why there are not enough people managing patients in tuberculosis.

Alienation

Hochschild (1983) argued that the exertion of emotional labour draws upon one's own sense of self. Due to the prescriptive and controlled nature of feeling rules, their enactment is exploitative and leads to an inauthentic outward expression of emotion and self-alienation. Individuals, therefore, subvert themselves in order to carry out emotional labour and this has detrimental effects that are exacerbated by the invisibility of this undertaking. In order to manage the emotions of the room and those in the space, individuals engage in what Hochschild terms 'surface acting', which is,

[93] It is not guaranteed that health professionals will receive financial compensated for contracting tuberculosis as, with tuberculosis being an airborne disease, it may be difficult to prove that they were infected on the job.

> the ability to deceive others about how we are really feeling without deceiving ourselves, and 'deep acting' whereby an individual has invested so much in evoking and acting an emotion outwardly that we deceive ourselves about our true emotion as much as we deceive others (Ibid., 33).

In her analyses of the job of air hostesses, she found that alienation can arise in three ways: when the individual becomes so good at deep acting that they overidentify with their work and become vulnerable to stress and burnout, particularly when the work goes to scale; the individual becomes so proficient at separating themselves from their outward expression of emotion and surface acting that they start to blame themselves for being inauthentic and insincere, leading to alienation from their work; the individual becomes estranged and disillusioned from the acting and starts to see themselves and their work in a cynical light, leading to alienation from both themselves and their work. In the following, health professionals' alienation from their work can be clearly observed. However, I agree with Catherine Theodosius' observations that health professionals who can identify and articulate their alienation from their work and know the discomfort they experience from the exertion of emotional labour "suggests that their sense of self is intact" (Theodosius 2008, 217). Alienation from one's job is sufficient for wanting to quit or not wanting one's child to enter into the same difficult occupational arena, however.

Labouring in Context

Returning to the opening scene on evaluation day, we recall Dr. Sun's frustration regarding whether she will lose a point from her work performance score because of a non-compliant patient. As she relayed to me, she had spent a lot of effort trying to motivate this young individual to take their medication throughout the time that he'd been assigned to her. Regardless, officially on paper, the point is either lost or not and Dr. Sun is either penalised or not for the management outcome of this patient despite the considerable emotional labour she exerted. Again, loss of point(s) means a reduction in her salary and the possible reduction of departmental funding. Dr. Sun was at a loss when she asked what else could she have done to earn that point for the department?

It is when recounting stalemate situations such as these that health professionals inform me that they have no *quan* (权; power). They explained that they are not licenced to prescribe drugs, unlike clinical doctors, nor can they enforce patients to take their drugs as preventative health professionals. This is the case even if the patient has DR-TB and is smear positive. Their performance scores are based

upon whether or not patients complete treatment but, crucially, they have no real authority to make sure that this happens, even if they make huge efforts towards that end. Some health professionals expressed compassion for the hardship some non-compliant patients deal with; others were less understanding. Across the board, however, they all expressed the need for public health workers to have the *legal* ability to require patients to finish their treatment (as discussed in Chapter Three) and, in the case of smear-positive patients who pose a risk of infection to others, to be able to restrict their mobility.[94,95] Health professionals from all levels of the tuberculosis control programme recounted cases of individuals who knew themselves to be smear positive nevertheless taking public transport and spending time in close proximity to others or with many people in enclosed spaces. They argue that by doing so, these people were potentially responsible for infecting others, of spreading tuberculosis infection, and for threatening society's health, which should be treated as a criminal offence. They compared how this public health law exists in the U.S. and lamented that health professional in China do not have this *quanli* (权力; authority).

This expression of frustration was usually quickly followed by the practical, however. Involuntary incarceration in prisons, like in the U.S., would not work in China due to the much higher prevalence – where would they secure all the patients? But they reasoned that the *quanli* to restrict the mobility of these individuals is at least necessary and that treatment completion should be compulsory in those instances for release. Community doctors in particular questioned what power they really have for carrying out this work. From their perspective, in addition to not having *quanli* to manage problematic patients, drug-resistant or otherwise, they are also perceived as not having the same *quanli* as clinical doctors and they are disregarded by some patients as a result. And yet, their performance evaluations measure for treatment compliance, completion and cure using a one or zero only, with no regard for the emotional labour they engage in to manage their patients.

> 要么权，　要么钱.
>
> *Yaome quan, yaome qian.*
>
> You either have power, or you have money.

I first heard this saying after witnessing a strained interaction between a clinical doctor and a patient during an outpatient appointment in a pulmonary hospital. Dr.

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[94] In Macau, individuals with a confirmed tuberculosis diagnosis are not restricted in where they can move within Macau but they are not permitted to leave the country or the province.
[95] We have seen this ability carried out en force, however, through China's Covid measures.

Ying (应) recited it as an explanation of what I had just witnessed. The patient was an elderly man accompanied by his son. The elderly man was drawn and grey, very thin, and sat in the chair without saying a word while his son did all the talking. Dr. Ying had just looked at the patient's chest CT and confirmed a diagnosis of tuberculosis. It was advanced enough that she advised hospitalisation for initial treatment. She informed them that there were no beds in the hospital and that they would have to go to another facility; the nearest being the hospital where they'd had the CT done – the one they had just come from. Patients expressing anxiety after receiving a diagnosis of tuberculosis is to be expected, but the son became openly unhappy at this point and demanded that his father be admitted to the hospital. Dr. Ying curtly repeated that there were no beds. Her body and masked face were turned towards the computer in front of her with only her eyes looking sideways at the visitors. The son demanded again that they admit his father, this time with his voice raised,

> We came here four days ago because my father has such a bad cough and was sweating. We got the X-ray as asked, you read it and told us to go to Punan Hospital for a CT. My father is old and sick and can't make these journeys on his own. I have to take time off work every time to make these visits and scans. We went to Punan and waited for a long time to have the CT. We went back today to collect it and then came back to you to read it. Now you're telling us to go back to Punan Hospital again to see *if* my father can finally receive treatment?! What if they are full too? What do we do then? What happens to my father? You're the doctor, don't you have any sense of responsibility for your patient? Can't you help him to get the treatment he needs? And I know that if we had enough money you'd make sure that there's a bed for him here. All of you doctors are the same and black-hearted [黑心; *heixin*]. He is an old man!

The son and father stood up to leave at this point; Dr. Ying had looked back to her computer screen while the son was speaking. She replied saying that it's not her hospital and that she didn't make the rules, also in a raised voice. There were a few more sharp comments thrown back and forth until Dr. Ying called for the next patient to come in. Later, she explained that,

> Previously people had *quan* because they had *quanwei* [权位; *power by virtue of position*]. They had *quanli* [权力; *authority*] because they occupied a *quanwei* by being a government official for example, or if they were elder, or

because they served a particular occupation and were experienced, like being a doctor. These days, people who don't have *quan* feel that they are entitled to the same power if they have *qian* [钱; money)] *Qian* affords you *quanli* [权利; *right to benefit*] and so these people feel that they should receive a particular outcome if they have spent money. Sometimes people expect that the patient should be completely cured, which might not be possible in particular instances. Unsatisfied family members then say that they've spent so much *qian,* how can their loved one have died? It must be because we health workers didn't treat the patient well or do our jobs properly. You've heard of the violent attacks on clinical staff? This all creates more and more distrust between patients and health workers, affecting the clinical relationship, and resulting in, as we've seen, patients behaving like that in appointments and, on the extreme end, increased patient-doctor violence. It's very difficult to be a doctor now. I will not let my daughter become a doctor.

The phenomenon Dr. Ying described has consistently featured in Chinese and international media, with multiple acts of violence carried out against health workers, many of them fatal, every year since at least 2000 (Tu 2018; e.g., Yao et al. 2014) . The underlying reason for these extreme acts has been attributed to the rapid rising cost of healthcare in China and the lack of legislature to deal with the emergent effects of this change. Healthcare, previously provided by the state during the Maoist period as per the Soviet model, was commercialised in the 1980s and costs have increasingly become the responsibility of the patient (as discussed in Chapter One). The state's withdrawal from public health funding has meant that hospitals must largely fund themselves (e.g., Li Wang, Wang, et al. 2019; W. Yip and Hsiao 2014). These institutions have pinned clinical doctors with the responsibility of generating some 80% of hospital funds from drugs sales and procedures, with the excessive prescription of medications and procedures not uncommon (Chan 2018). The concurrent rapid rise in healthcare costs coupled with the shift from state-funded to what looks more like a neoliberal model of healthcare consumption and provision has meant that *laobaixing* (老百姓; *ordinary people*) are unable to keep up with the costs of seeking medical help.

The state has introduced public health insurance (医保; *yibao*) for urban residents only across China.[96] A set amount is transferred to one's public health card

[96] The New Cooperative Medical Scheme was introduced in 2003 to provide rural residents with basic public healthcare (Tu 2018).

at the beginning of the year that can be carried over if not used and accumulated over time. This amount is enough to pay for routine drugs and visits to the doctor, and significantly insufficient to support any kind of chronic or substantial medical condition and its treatment (see Chapter Four for more discussion). Hospital fees, doctors' fees, nurses' fees, scans and tests, drugs and therapy, nursing care, even oxygen if required – everything costs money. Stories of *laobaixing* emptying their life's savings in efforts to help their loved ones and it still not being enough often accompany these reports of violence. Other stories of family members threatening medical staff in order to elicit a pay-out from the hospital to placate the threats are also common. The police are often called upon in these instances of *yinao* (医闹; *medical disputes*) but, as they are not considered instances of criminal activity, the hospital is expected to resolve these highly contentious instances of patient-doctor violence itself.

The development of this state of affairs contributes significantly to the deterioration of the public's trust in the Chinese healthcare system at large, with the rise of *yangsheng* (养生; *nourishing life*) in response to the sentiment that one must maintain one's own good health and not get sick because healthcare is unaffordable (Farquhar and Zhang 2012). In the quotidian, the effects of this pressurised system are manifest in the now commonplace lack of mutual trust and respect between patient and healthcare worker alike, along with the reconfiguration of *quan* and more centralised place of *qian* in how people and medical staff and institutions interact. The effects of these clinical encounters also saturate how public health professionals are more generally regarded.

Routine monitoring or novel screening projects mandated by the national CDC often entail phoning patients at home or on their mobile phones to ask them questions about their health. Community doctors often experience being hung up on; spoken to disrespectfully; and even receive verbal abuse when making these phone calls. For many of them, it was something that they found *tongku* (痛苦; *painful*) but have no choice but to have to carry out. Some doctors attempt to try to understand why the person receiving the call might do this. Explanations include suspicion fostered by the well-known culture of bad patient-doctor interactions, and short fuses from receiving numerous scam calls every day, which is commonplace in China. Another reason offered is the public's unfamiliarity with preventative medicine.

> now in China, preventative medicine is not really respected because the idea or concept of us [preventative health doctors] or preventative medicine is not understood. [People] feel that if they are sick then they just go to the [clinical] doctor to get treated, that they don't need to do this preventative stuff. (Dr. Fan)

Nevertheless, whether or not they can understand the motives for such behaviour, community doctors describe how they 'suffer a lot' and are left feeling 'emotionally low' in having to man the frontline and interface with people who had not themselves sought out for their health to be managed. This is in contrast to their clinician counterparts, whom people seek out for medical assistance and to access curative medicine.[97] In the general public's conception, a doctor is someone who can diagnose and heal a patient. They are able to write prescriptions and provide access to medications and treatments that result in the person feeling better and regaining good health. Public health professionals are not permitted to write prescriptions nor give out medication, and a sick person may not feel better or healed after interacting with them. In fact, the individual may not feel sick at all if they are receiving a cold call from a community doctor enquiring about dengue but, rather, may hang up feeling bothered and angry. As observed by Dr. Fan, this approach to 'monitor', 'screen', and ensure 'early detection' of disease and health risks engages a form of surveillance used in public health medicine that *laobaixing* may not conceive of as 'medicine'. As community doctors explained, they may wear a white coat but they do not receive the *quan* nor the respect that purportedly comes with it. Instead, they must brace against the suspicion, discrimination and, at times, abuse associated with bearing this mantle in today's market-era China from people who feel they are being bothered rather than cared for by them. Their comments demonstrate the inherent ambivalence, malleability and interpretability of care, and highlight how the wider socio-economic and political details matter when receiving care as something welcomed or resented, considered beneficial or bothersome, and experienced as healing or constricting. Health professionals exert emotional labour in their thinking-with and acting-with a care that attends to these details.

CONCLUSION

The health professionals in this chapter have elucidated the quotidian emotional labour they carry out and the effects of audit cultures on them, their work, and their financial security. I have examined the case of how one community doctor engaged with the care of her patient who was refusing to take their medications. Dr. Sun went above and beyond and exerted considerable emotional labour to encourage her patient to keep up treatment. In the end, her patient refused to continue taking his

[97]. Public health professionals are here expressing their frustrations at not being recognised as a medical professional and how it confounds their ability to carry out their work. However, it is worth noting that clinicians also experience mistrust and suspicion (e.g., Chan 2018; Nie et al. 2018), even if they are sought out by patients.

medications and Dr. Sun was ultimately unsuccessful. However, the considerable efforts she made will not be officially recorded nor reported, even though they were successful in maintaining treatment adherence for a time. Rather, only metrics stripped of history, context and circumstance matter and 'success' is constituted by whether targets are achieved, with failure to meet these targets penalised by points deduction and possibly salary reduction as per protocol. Emotional labour is found to be functionally invisible despite being a vital aspect of patient management – a quintessential example of expertise inertia – due to the optics and biases imposed by practices of audit cultures.

Researchers have expounded on how those who do the counting are transformed into 'auditable' entities through the practices of audit culture. However, I have further drawn on Andrew Kipnis' call for governance through audit cultures to be considered in their local contexts as opposed to as a singular neoliberal force only. In the Shanghainese context, extending this consideration means that health professionals may be rendered as auditable entities and/or also be civil servants within a hierarchical system who are 'examined through evaluation' on their contribution to the country's technocratic development. The pressure to maintain the *biaomian* or surface appearance is so great that health professionals report the practice of falsifying results when there is *meibanfa*. In these incidences, health professionals exert an emotional labour that incorporates affective performances, whereby their attention is turned upwards and they carry out actions that attend to their managers' comforts and facilitate their ease.

The technocratic practices of audit culture(s) therefore further entrench the invisibility of emotional labour and the effects of alienation that health professionals experience. The health professionals in this chapter carry out their work in between policy and practice within the wider context of contemporary China. The country's embrace of capitalism has had significant effects on its public health system, including the rising mistrust of health professionals and patient-doctor violence. The consequences of these effects pose challenges for health professionals' ability to carry out their roles and, thus, to the tuberculosis control programme itself. Moreover, the invisibility of emotional labour and ignorance towards the vital role it plays in patients' recovery results in an anti-politics of care, an apoliticisation of intervention. This *maodun* both perpetuates the laboured (re)telling of stories of 'the suffering stranger' (Butt 2002) and compounds health professionals' ability to carry out their jobs both practically and sustainably. Finally, the exclusion of these health professionals' voices and expertise from conversations on policy and programme

design leads to expertise inertia that, together with data inertia, sabotages the process of indicator refinement that may be beneficial for tuberculosis control.

Interlude: Dr. Jia and Dr. Lin

Outsiders in Shanghai

Ting Ting: Why did you come to Shanghai?

Dr. Jia: It's a big city. Us Chinese people [我们中国人; *women zhongguoren*] like to go to big cities, we think there's a future for prosperity.

Dr. Jia (贾) and Dr. Lin (林) were young doctors at the beginning of their careers when I met them. They had been recruited from other provinces by a community health clinic (CHC). This has become common practice, with less and less new graduates in public health willing to work in a CHC due to the low salaries. As low as they are, salaries in Shanghai are still higher than those in other provinces however and many, like Dr. Jia, believed that big cities offer better possibilities for career and financial success. Sitting on small stools in a shoebox meeting room in the CHC, Dr. Jia and Dr. Lin helped me to understand more over the loudspeaker announcements calling out the next number in line for paediatric vaccinations.

Dr. Jia: Before coming I thought Shanghai, it must be really modern. With skyscrapers and big buildings, that it must be really lively. And then I came to this area and it's so different! There's nothing in this town that gives you a real modern feeling. We're here at the intersection of the city and the countryside. But it's very handy for going to the city centre. I had never seen Shanghai before, I just knew that it is China's number one city, the most prosperous, the best city. But then I came here and it's pretty similar to my hometown! I've been to the city centre a few times with my housemates, and that's big. But here [where he's living], it's pretty normal! It's not so flourishing but the salary is higher than in my province.

The CHC that recruited Drs. Jia and Lin was located in the suburbs of Shanghai. It was well connected, as is much of the metropolis – Shanghai currently has the world's largest and longest metro at 831 km – but it sits at the edge of the city and is a far cry from the tall skyscrapers of The Bund or other images of a glistening Shanghai that Dr. Jia might have had accepting the job offer. Rather, Dr. Jia has found his corner of

Shanghai to be not dissimilar from his hometown but this is not his hometown, and he explained how this is felt through his daily work.

Dr. Jia: Working in a CDC in China, so many things are dependent on *guanxi*. It's not so easy to get through it if you don't' have *guanxi* or if you don't know the people in the organisation. Even if you achieve high results and work hard, they won't want you if you don't know anyone. It's a very real thing. It won't be outrightly said but it'll be done behind doors. You have less *guanxi* if you're not from here. The same for managing patients. If you don't speak Shanghainese, if you open your mouth and patients hear that you're *waidi* [外地; an outsider] they won't trust you. Just like if I was in my hometown and I started to speak the local dialect there, they would know that I am from there and they would trust me.

Health professionals recruited from outside of Shanghai, particularly those in direct contact with patients such as community doctors, often expressed the challenges of working in a highly local environment. At the same time, community doctors, particularly those in CHC further from downtown Shanghai, are increasingly recruited from other provinces due to the low salaries and demanding work that deters local graduates from the job. Dr. Lin explained that this results in a large turnover in staff as *waidi* recruits struggle to stay in Shanghai long-term with its high living costs and the felt impossibility of buying a house.

Dr. Lin: Because it's a civil servant's job, it's not like you do your best and you'll get more money. The salaries are all set by above. New people come, they stay a couple of years and then they leave, and then the next bunch come. Because it's so expensive; I couldn't imagine buying a house here. Maybe new graduates don't mind because they don't have to think of these things but later, when you get older and want to do things like get married, then you might think of those kinds of things. Especially men, they have so much pressure, they are likely to return to their hometown. Many go back because they don't feel a sense of belonging [归属感; *guishugan*] and this affects their work. If you don't feel well inside you might not perform your work earnestly [认证; *renzheng*).

In this office, there's someone who manages diabetes. He's been here for ten years, his son is almost five years old. He's also from my province

but he lives so arduously [艰辛; *jianxin*] here. He has a child and it's very expensive but our salaries aren't very high. There are so many people with so much money in Shanghai though and they can afford it. He told me he will continue to stay here because it's not easy to find another job in public health and Shanghai's salaries are higher than in other places. But it does affect his work because he is so worried all the time. He told me that he should have chosen to stay in his hometown after he graduated. Even if the salary isn't as high, the houses are not so expensive and you're near family. He doesn't get to go home often. So, in the end, Shanghai doesn't have enough public health talent [人才; *rencai*] because Shanghai has a few very good medical schools and the graduates from those good schools are unwilling to come to this level [to work]. They start off expecting more for themselves. They don't want to do this public health work that's so messy [乱; *luan*].

Despite being aware of these issues, Dr. Lin hoped to stay in Shanghai. She liked being in the city and had made some friends. Her salary would be far less in her own province so she was willing work here for another few years. Her only qualm was that the air pollution in Shanghai is much more severe than in her hometown. She reasoned that the country was becoming more environmentally conscious, however, and she hoped that this would improve over time.

Dr. Jia had similar plans to stay for the time being in Shanghai but he also had definite plans to return to his own province.

Dr. Jia: I want to go back because I can't buy a house here in Shanghai based on my salary. And even if I could, my parents wouldn't come to stay with me here. Because they didn't really have that much schooling, they don't speak Mandarin Chinese [普通话; *putonghua*] very well, and they'd be bored if they moved here. They have friends and their relatives at home. I want to take care of them.

Chapter Six

Storytelling Through Scale-making

> In fact, we might see number crunching and metrics work as, in their own way, forms of storytelling. They tell stories about what those who produce them and what those who rely on them care about most. (Adams 2016, 9)

> In a sense, anthropology from its inception has been preoccupied with matters of scale, focused as we have been on questions of what is particular to the places and peoples we study, and what, if anything, is shared by humanity as a whole. (Carr and Lempert 2016, 5)

This final chapter examines the stories that are told through the technocratic language of metrics at different scales of a tuberculosis control programme. Within the local Shanghai context, it tracks the route of a patient from the community to the municipal level and how the concept of who or what a patient is transforms as they and their file ascends the scale. Different stories of the same patient can be told at each level of the programme. These can range from recounting the vicissitudes of a person's attempts to pursue treatment, to their being subsumed as part of a percentage data point. This transformation is made possible through the practices of scale-making intrinsic to the design of the DOTS approach. These practices enable the empirical to be abstracted into the language of metrics, with numbers and statistics composing the units of its grammar, through which national and global health institutions communicate. The kinds of stories that are told at each level of the scale depend on the kinds of data that inform those who interpret the numbers and tell the stories. This chapter is interested in the nature of these data and how they transform as they travel up a scaled global health programme.

Attending to scale is central to understanding how a technocratic programme such as DOTS operates fundamentally. The quality of scalability – that a locally applied project ought to be able to function in the exact same way when inserted into any wider, bigger context – is one demanded of projects and programmes today. Possessing this quality asserts the endeavour as being a 'modern' one, and as one imbued with the attributes of reliability, robustness, replicability. The ubiquitous use of numbers in these kinds of programmes ties them to claims of the scientific and objective (e.g., Adams 2016; Merry 2016) and even 'natural' (Greenhalgh 2008), and the given professionalism of the experts trained to carry them out a given. These

characteristics draw the endorsement of official institutions, which at once legitimises both the programme and the institutions themselves as the two mutually reinforce the other's claims to the scientific and expert. The quality of scalability is thus a core component of what modern projects and programmes need to possess in order to be applicable in today's secular and globalised world. As put by anthropologist Anna Tsing, the ability of projects to 'scale-up' and possess "the possibility for infinite expansion without changing the research framework"...has become a hallmark of modern knowledge" (Tsing 2017, 37-38).

Stories can be powerful as they "do not simply reflect a reality that exists in nature; instead, they can actively constitute reality by shaping what is thinkable" (Greenhalgh 2008, 10). Continuing in the words of anthropologist Susan Greenhalgh,

> A fresh and compelling problematization [or version of the story] can radically reorient thinking about the nature and scope of a social problem, making people see the matter in completely new ways. If it gets embedded in public policy and bureaucratically enacted, a powerful problematization can remake the world we live in. (Ibid.)

The previous chapters Four and Five have explored the ways in which the language of metrics is used to create, define, surveil and audit the nature and scope of tuberculosis control. The realities of patients and, indeed, those of the health professionals carrying out the programme are judged in binaries of one or zero; of success or failure. This is the case regardless of the history, context and circumstances involved or emotional labour exerted, whereby numbers render the conditions of reality commeasurable across space and time. Moreover, this form of 'new governance' determines what is made visible and what becomes obfuscated or relegated to the realm of invisibility. Thus, knowledge is made "through language and linguistic framings...[that] can present a single reality in multiple ways" (Ibid.) depending upon what gets included, excluded or precluded. With this language and these linguistic framings incorporating the censoring effects of data inertia and expertise inertia (see chapters Four and Five, respectively), and the transformative process made possible through the practices of scale-making, this chapter seeks to explore the kinds of tuberculosis control stories that are told and by whom at the local, national and global levels that can (re)make reality and influence the shaping of public health policy and protocol.

The chapter is organised into two parts, with Part One being comprised of two sections. Part One, Section One introduces what has been identified as the practices of scale-making. Part One, Section Two examines the stories told by health professionals to assess how these practices are applied within the local

Shanghainese setting. Part Two 'scales-up' by zooming out to further reflect on the use of scale-making practices and the roles stories of scale play in the official narratives told by China and other global health institutions. Essentially, the discussion shifts from examining the local machinery that produces data in Part One to the storytelling that takes place through the language of metrics at the national and global levels using this data in Part Two.

Therefore, the following Section One discusses the practices of scale-making that enable a programme to be implemented in any place at any time. Inherent is the assumption that, through undergoing these processes, concepts such as patients, microbes (see Chapter Two for more discussion) and protocol are rendered fixed and applicable in exactly the same way at any scale and in any setting. These practices, in theory, enable storytelling of the so-called 'one-size-fits-all' approach.

In Section Two, we turn to the local SCDC as a "scale-making project" (Tsing 2000) and examine the practices of scale-making at the community, district and municipal levels through the storytelling of health professionals. It tracks the transformation of an individual patient into a number on a well-populated spreadsheet as their case ascends the scale. The section discusses how health professionals come to conceive of and act towards these concepts as they simultaneously produce them.

Finally, Part Two zooms out to consider the purpose of scale-making – why this technique is used and what it achieves – and its wider significance. Specifically, it explores the importance of population control to the Chinese state and the project of global health. Indeed, the issue of scale for public health is one linked to population. The use of scale-making practices is considered necessary because certain kind(s) of aggregate(s), in the public health imagination, require management and order. Notably, these aggregates are co-produced and reproduced through the enactment of the programmes designed to manage them (Jasanoff 2004; e.g., Ticktin 2011). The ability to manage large aggregates and populations demonstrates capability and reinforces the stories that are told and that contribute to the official narrative of China's rise as "a scientific and technological modernizer capable of engineering the use of S&T [Science and Technology] to achieve national wealth, power, and global status" (Greenhalgh and Zhang 2020, 9). Furthermore, these stories bolster the official narrative of progress being made by global health programmes towards the control and inevitable eradication of the world's most intractable health issues as long as there is patient compliance, scientific research and expertise, and adequate funding. Crucially, however, these stories are informed by data generated at the local levels and, as the previous chapters have explored, the public health privileging of

numbers and statistics and its engagement in the practice of audit culture(s) results in data that suffers from data inertia and expertise inertia, as well as the reductionist effects of scale-making. It is thus cause for pause, to consider the kinds of realities (re)made by the telling of these stories and official narratives that are based on data that may be 'correct' but not necessarily 'true' (K.A. Mason 2016b, drawing from Blaum).

PART ONE

THE STORIES THAT SCALE MAKES

> Scale is the spatial dimensionality necessary for a particular kind of view, whether up close or from a distance, microscopic or planetary. I argue that scale is not just a neutral frame for viewing the world; scale must be brought into being: proposed, practiced, and evaded, as well as taken for granted. (Tsing 2005, 57)

In this quote, Anna Tsing distils the phenomenon of scale into two sentences. I follow her example in understanding scale as a function of perspective and that it is changeable, malleable and manipulable depending on what angle you take. Moreover, the attributes of changeability, malleability and manipulability are such because scale is made and not a given. The veracity of scale is produced and maintained through the creative processes of rhetoric and performance; for example, through the production of documentation, carrying out of human action, or the synergy that comes into being through global assemblages of sociality. Scaled realities are conjurings (Jones 2017; Tsing 2005) brought into being through actions and arguments so convincing that they become ideological (Gal 2016; Irvine 2016). Anything that runs contrary to or is inconvenient for this truth is discredited, denied or even deliberately ignored and/or omitted. Scale constructed in this way orders the world into relational terms (Howitt 1998) based on a particular perspective – usually that of the scale-makers – that is believed to be 'the ways things are'. The institutionalisation of these perspectives often then cements the power and position that these perspectives have over others.

Scholars from different disciplines have developed the analytic of scale and its effects. These include historians of science (e.g., King 2004), STS scholars (e.g., Kelty 2006), geographers (e.g., Howitt 1998; Sayre 2009), and anthropologists (e.g., Tsing 2017; see Carr and Lempert 2016 for an edited volume). Many of these studies have applied their analyses of scale through examining how assemblages of social forces intra-act to produce the establishment of a scalar relation; for example, see King (2004) for a study into the politics of scale that cultivated the arguments around

‘emerging diseases’, thereby justifying that public health endeavours necessarily adopt a spirit of ‘preparedness’. Similarly, in the next section I recount the perspectives held by health professionals at all three levels of the tuberculosis control programme and examine how those working within these programmes understand, negotiate and enact these practices of scale-making. In doing so, I hope to achieve two things: first, to demonstrate that scale is not an objective fact but, rather, a reality that is being continuously made and which is effortful to conjure and maintain, even after it has been established. Second, by demonstrating the constructed nature of scale, I seek to reveal the processes and transformations, both conceptually and practically, that must continuously take place in order for the programme to justify and sustain the categories and concepts it creates. However, as explored in previous chapters, the transformation of the patient into an ever more abstract (i.e., numerical) concept as they are handled further up the hierarchy, coupled with data inertia and expertise inertia, confound the programme’s ability to respond to and incorporate wider issues of patient management into consideration. This ever-narrowing perspective incurs blind spots or even mistaken beliefs (Merry 2016) that offer possibilities for microbial experimentation and drug resistance to take hold. These possibilities may sabotage the purpose of the programme and promote the proliferation of DR-TB. The previous chapters have shown how health professionals at every level of the STP work to manage the *maodun* that arise between the demands of DOTS and the lived realities of patients. The present chapter explores the same in terms of scale-making.

The practices that enable scale-making are plural and simultaneous, interweaving and intra-acting in how they produce and maintain the stories of what public health today ought to be and do. Anthropologists have explored some of these processes (e.g., Carr and Lempert 2016), many of which have been explored and discussed in the preceding chapters. These include: numerical dominance and objectivisation; the characterisation of populations in order to categorise, measure and control; claims to the scientific and use of institutions to legitimise perspective and goals and, thereby, reinforce ideology (what Miriam Gross has called ‘scientific consolidation’ [2016]); the production of documentation or inscriptions that reinforce the ‘realness’ of the scale; the denial and/or ignoring of issues that contradict or complicate the scaled reality; the use of rhetoric and pragmatics that foster the sense of urgency – for example, through emotive language or promises of a better future (Venkat 2021) – to justify and galvanise the acceptance of programmes, institutions and scale-making measures. The following ethnography will track how the concept of ‘patient’ transforms as it ascends the hierarchy and demonstrate these scale-making practices in application.

TELLING STORIES OF SCALE-MAKING

In Chapter Five, we were introduced to Dr. Sun's difficult teenage patient who started and stopped his tuberculosis treatment. Dr. Sun had done all she could to encourage and support her patient to continue his treatment. However, the patient finally refused to take any more antibiotics, insisting that he didn't care if he lived or died. This section will explore this patient's case in more detail to demonstrate the transformations the concept of 'patient' must undergo at each level of the tuberculosis control programme to enable the enactment of 'scaling up'. Specifically, it will examine how patients are referred to and conceived of at the levels of the community, district and municipal, and how they are understood and managed as a result. Doing so demonstrates scale-making in action and reveals the practices that enable the municipal-wide application of DOTS. This process produces data that inform stories of tuberculosis control at each level of the scale, including those that inform imaginaries of the aggregates upon which the design of public health programmes is based. It is in this way that public health programmes produce the very objects of 'patient' and 'public' towards which they are directed.

The Community Story: The Patient as an Individual Person

The patient was nineteen years old; let's call him Xiao Zhang (小张). Dr. Sun told me the story of how Xiao Zhang didn't apply himself in school and would instead spend a lot of time in internet bars. His parents became very concerned and his father quit work to take closer care of his son. Xiao Zhang continued to run off to internet bars however and grew thinner and thinner, described as having only a few *jin* (斤; five hundred grams) on his bones when they finally brought him to the local hospital. He was immediately diagnosed with tuberculosis with a positive sputum smear. When Xiao Zhang's *lianse* (脸色; *face colour/pallor*) deteriorated, the head of the local hospital became concerned that his case was too complicated to treat in the local facility and suggested that he attend the Shanghai Pulmonary Hospital (SPH) instead. Xiao Zhang was then admitted and treated in the SPH. Afterwards, he was discharged home but became very pessimistic about his illness and didn't want to continue treatment. When Dr. Sun rang him to enquire as to why he said that he didn't care. "People have to die anyway", was Xiao Zhang's despondent response.

Dr. Sun arranged to meet with him and spent time slowly trying to get through and encourage him (开导; *kaidao*) to not give up his treatment. She also tried to

communicate (沟通; *goutong*) with his family members and encouraged them to communicate with each other. Dr. Sun described how,

> I got through to his father and said that no matter what the reason, he's still your child and as parents you have to help him. If your parents don't support you, then what do you have? The father then told me about their financial difficulties and so I got in touch with the district CDC and the designated hospital, and we arranged for the SCDC to pay for all examinations. In terms of drug costs, some medications like liver protection medications can only be partially reimbursed, with the amount capped at RMB 800. I had a recovered patient who had a big pile of liver protection medications left over the end of their treatment and I appealed to Dr. Gao at the district CDC if we could give them to Xiao Zhang for free – there were over two dozen boxes. Dr. Gao is always reasonable and considered my request, but there was a legal issue to address. Those drugs require a doctor's prescription but I am not his clinician. I'm only his managing doctor [管理医生; *guanli yisheng*] and so I was crossing boundaries. After discussing it, Dr. Gao and I decided that we could sign an agreement stipulating that the patient consents to receiving these medications for free; that they are the same as the ones his doctor prescribed; that they are from a legitimate pharmaceutical company; and that I would be waived of any responsibilities if there are any bad outcomes.

Through her exertion of emotional labour (see Chapter Five), Dr. Sun was able to convince Xiao Zhang to attend the local clinic and continue his treatment at home. He did this for a further nine months with good treatment results. Dr. Sun described how Xiao Zhang used to lie in bed unable to move at first but then slowly started to gain weight and the ability to do everyday things again. However, following this period, he stopped taking his medications again and insisted that he would not recommence them. Dr. Sun stated that she didn't know the cause of this second break in treatment and that she could only guess at the reasons.

> At first the benefits from the drugs were dramatic and clear but after a while, his recovery seemed stuck at a certain stage. Treating tuberculosis is not just about taking the medications. You also need to rest and to manage and maintain your nutrition. His family are not well off and I feel that perhaps he wasn't receiving enough nutrition and that this, at a certain stage, slowed down the recovery period a lot. I'm guessing that Xiao Zhang started to feel discouraged and negative towards his condition again. I went to visit him a few

> times, both by myself and with another doctor, and the district CDC rang him and explained to him the seriousness of his not continuing his treatment. Xiao Zhang wouldn't recommence his treatment, however.

When Dr. Sun recounted this case to me, Xiao Zhang was still refusing to take his medications.

Dr. Sun's account offers us much insight into the relationship between the community health doctor and patient within the community setting; at least from Dr. Sun's perspective and how she understood and enacted it. Dr. Sun needed her young patient to complete his treatment in order for her to gain the points she needed for her six-month evaluation. However, it is also certain that the actions that Dr. Sun took in striving to assist her patient were substantial. She treated Xiao Zhang as an individual person in need of attention, time, encouragement and financial support. She took the time to enquire into and gain knowledge of the familial and personal issues this individual was contending with, and the patient and family invested trust in Dr. Sun when they shared their challenges with her. She identified that the remit of her care was not limited to the patient only and she spent considerable time and energy engaging with and encouraging Xiao Zhang's parents to support and not give up believing in their son's potential to recover. Dr. Sun, therefore, supported the whole family and even surpassed her community doctor responsibilities by seeking out further support for the family from the district and municipal levels. She did so in response to what Xiao Zhang's father had told her about the financial challenges to his son's recovery. She paid attention to the family's specific context and listened to their personal circumstances, and problem solved. To Dr. Sun, Xiao Zhang and his family were not only the static categories of 'patient' and 'family members' – they were people in need of assistance to finish treatment.

Dr. Sun occupies an interstitial position in between the patient and policy. As a result, she was privy to information and knowledge from both sides that she then drew upon in her attempts to mitigate her patient's treatment difficulties. She personally advocated for Xiao Zhang's tests to be provided for free by the municipal laboratories and for the district CDC to supply him with the surplus hepatic medications. When ethical issues arose from this latter workaround, Dr. Sun worked with Dr. Gao to come up with a solution so that her patient could receive the drugs – this had not come up before and so they were figuring out the ins and outs of a novel alternative. Moreover, she did this knowing that it overstepped her responsibilities as the *guanli yisheng* in doing the job of the clinical doctor (临床医生; *linchuang*

yisheng). Every action that Dr. Sun carried out beyond the SOP stipulations was therefore 'off the (hand)books'. She carried them out based on her personal judgement of her relationship with and responsibilities towards her patient, to Xiao Zhang, and not on what is prescribed by policy. However, none of these actions that took time, energy and will to enact were noted in official community patient management records. The whole engagement was instead recorded as boxes checked or left unchecked: home visitation – check; timely taking of medications – check; timely hospital check-ups – check; timely retesting and scans – check. These documents become the evidentiary proof that the programme is operating in a timely and smooth manner – that it is 'successful'– without ever noting the volume of emotional labour, care and innovation (see Chapter Five) involved to render its appearance as such. Instead, in terms of what gets officially inscribed and reported to the national CDC, this labour is rendered invisible, with the effect being that it did not take place. Only the smooth and timely progression of programmatic treatment becomes part of, and shapes, the acknowledged and known metric record of reality.

District Stories: Another Doctor's Patient, and Keep Your Cards Close

Dr. Sun appealed to Dr. Gao (高) in the district CDC offices. Dr. Gao heads patient-monitoring and is well-known for being approachable. Dr. Sun explained that she had often worked with Dr. Gao to problem-solve complex patient cases. She finds him open and willing to innovate fixes so as to help community doctors not to lose points as well as for the benefit of the community doctor's patient. Occupying his position in the district CDC, he is responsible for a community doctor's performance in managing their patient. That is to say, the patient is not Dr. Gao's: it is Dr. Sun's patient, but Dr. Gao is accountable and directly answerable to the municipal staff for the outcomes of Dr. Sun's management efforts.

Dr. Gao may not meet the patient he discussed at length with Dr. Sun. Unless necessary, he will mostly likely not meet Xiao Zhang or his parents, nor visit their rented home where the nineteen-year-old watches television and refuses to continue taking his medication, stating that "people have to die anyway". Rather, Dr. Gao is aware of Xiao Zhang's situation and has made efforts to support his treatment. He thought of a way to legitimately circumvent the terms of policy to provide Dr. Sun with what she'd requested. Dr. Sun's performance metrics will impact the district CDC's performance ratings that determine funding for the next year so it is in Dr. Gao's interest to facilitate her requirements. In carrying out these actions, Dr. Gao was concerned that Xiao Zhang, a pulmonary tuberculosis patient with a drug-susceptible

infection, finish his treatment and not default. For Dr. Gao, patients comprise types of patients.

Pulmonary tuberculosis patients who have drug-susceptible infections; multi drug-resistant patients who have been on treatment for years; totally drug-resistant patients who are waiting to die; local elderly patients who forget to take their medications; migrant patients who can't afford treatment costs or become 'lost'; younger patients, like Xiao Zhang, with treatable infections who refuse treatment; student patients or factory workers; patients with HIV or diabetes comorbidity; latent tuberculosis (LTBI) patients; whether those in each of these categories have smear-positive or smear-negative infections. He referred to patients using these terms in lieu of names. Coupled with the likelihood of never meeting most of these patients in person, the degree of separation between Dr. Gao and patients is greater than that of Dr. Sun's direct engagement with those individuals under her care. This degree of separation is manifest and facilitated, even made real, by the distancing nomenclature district CDC personnel use to refer other doctors' patients. This distancing discursive practice is even more evident in the work of Ms. Wu (吴) within the epidemiology branch of this district CDC.

The municipal-wide Tuberculosis Information Management System (TBMIS) for online reporting has been in operation since 2005. Before that time, patient record-keeping was carried out using material documents sent through the postal mailing system. Registration of newly diagnosed patients and treatment progression and outcome were all documented using A5 cards sent from the hospital to the relevant department. It took time, however. In contrast, use of the online system ensures real-time notification and reporting of cases. The card mailing system is still in use today, if only to primarily function as a backup system: it enables cross-referencing and confirmation, and also acts as an archive. Ms. Wu works specifically with these A5 cards and supplementary A4 sheets in managing individual patient cases. "Each of these pieces of paper is like a close relative", she once commented, reflecting on the relationship that becomes from organising a patient's treatment updates for the duration of nine months to two years or longer.

Observing Ms. Wu, I was amazed by her skill and how systematic she was at decoding, recoding, recording and filing these multitudinous pieces of paper; these

material artefacts that travel the municipality with a recorded snapshot of a person and their attempts to get better. She is responsible for the registration of new cases and the reimbursement of those who have completed treatment. In doing this, she keeps a close eye to ensure that what she sees online and what is written on the card in her hand cohere. She is so deft at processing these cards that she can work with up to five piles at once, simultaneously managing the different modes of processing these documentation sent from general and designated hospitals undergo. For each swollen postal package received, she first scans the "graphic artifacts" (Hull 2012, 1) and then sorts them into piles of those relevant to tuberculosis management and others to be forwarded to other branches or disease departments.[98] She takes the top card from the tuberculosis card pile and enters the inscribed information into the online spreadsheet: date; patient number; name; *hukou*; date of birth; male or female; hospital, hospital number; tuberculosis or pneumonia; smear positive or negative; province; district; address in district; district number. That card then goes to the top of a second pile that will be filed away for the department's records. Next is the top sheet on the A4 sheet pile with even more patient information to be inputted. After being processed, the sheet is placed on top of a fourth pile and is later posted to the corresponding CHC or, if there is information missing, returned to sender. Dr. Wu receives card updates from the designated hospitals each time a patient attends an appointment for scans, tests or prescriptions. This is the case for all hospitals except the SPH, whose staff only send one card for a newly registered diagnosis and no more. "They have so many patients and they are senior enough that they can do their own thing, and so they only send us one card. There is nothing you can say to them, and they can get very angry too if you ask them! They can do what they want", Ms. Wu explained.

Ms. Wu is also responsible for allocating each patient with a serial number (编号; *bianhao*). Their case will then be registered under this number for the duration of their time with the programme. At the point of diagnosis, the clinician fills out a card for the patient, which they must present at each subsequent appointment; one for the hospital's records; and one to be sent to the district CDC for registration. This final card is then later handed over to the community doctor for their records. The *bianhao* Ms. Wu allocates is based on a Shanghai-wide coding system that, as described by Ms. Wu, "makes patients easily identifiable and traceable by looking at this number alone". For example,

[98] The documentation to be forwarded to other branches or disease departments comprises the fifth pile.

2	**1**	**13**	**05**	**052**
infection type	resident status	year	district number	no. of patients so far for that year

For the first digit entry, there are six possible infection types that can be denoted:

0. Local patient, standard pulmonary infection
1. Migrant patient, standard pulmonary infection
2. Local patient, pneumonia
3. Migrant patient, pneumonia
4. Local patient, non-pulmonary infection
5. Migrant patient, non-pulmonary infection
6. Migrant patient transferred from a different province to Shanghai

These cards are then filed away on site. The cards of patients who have completed treatment are stored in a filing cabinet. The active cards are kept in bundles according to year and numerical order and held together with an elastic band. They are stored in an orange wooden shelving unit. Ms. Wu created this system of filing and can easily find any patient. “It is so valuable as it provides a means of backup and double-checking”, she explained to me. However, she also expressed frustration at how some of her colleagues do not value the system as they should. She recounted an instance of what she meant.

A patient had been reported online as a ‘lost’ patient by their community doctor, but Ms Wu’s radar was raised when she continued to receive update cards for this patient from the designated hospital. She decided that this didn’t add up and rang the designated hospital for more information. The clinician there confirmed that the patient had a job in Shanghai, was resident in the city, and continuing to come in for appointments. Upon hearing this, Ms. Wu let her colleague, a young and newly graduated hire called Ms. Gong (龚), know about the mis-entry online. Ms. Gong subsequently rang the community doctor who informed her that they had rung the patient’s mobile and visited their address but had not been able to make contact. The doctor stated that he considered the patient ‘lost’ and that he shouldn’t have to bear the responsibility for a patient he cannot manage. Ms. Gong came back to Ms. Wu saying that she had rung the community doctor and confirmed again that the patient is ‘lost’ and was leaving it at that.

For Ms. Wu, it was obvious that the community doctor did not want to register the patient as 'active' and bear the responsibility for the completion of their treatment, especially as it was proving not immediately convenient to control, monitor and ensure their compliant behaviour. She found Ms. Gong to be remiss in allowing this misalignment to persist in the record-keeping and irresponsible at her job. In Ms. Wu's opinion, if Ms. Gong was to have cross-referenced the accuracy of the records, she should have rung the designated hospital (as Ms. Wu had) and not the community doctor who would predictably only reconfirm what he had originally reported. She was not happy and communicated as such to the branch head who did little to reprimand the new hire. The branch head told Ms. Gong to amend the online entry but did not report the incident to the department director as, again in Ms. Wu's opinion, she should have. To add insult to injury, when Ms. Wu asked the branch head for the patient card back, the branch head couldn't find it. After some searching, the card finally showed up on Ms. Gong's desk. Ms. Wu was furious as not only was the new hire, in her eyes, incompetent, but she hadn't returned the card to the orange shelving unit, demonstrating that she didn't value the cards nor the importance of the filing system. She said that she has managed the card recording system for fifteen years and is so familiar with it that she can detect discrepancies at a glance. I commented that she has good eyes, being able to discern and compare the details on the cards and the computer so quickly. Ms. Wu responded that it's not about having good eyes but about having a good brain. It's about understanding what you see.

In terms of managing patient files, Ms. Wu is an expert at what she sees. She described to me how astute but also selective she is with what she *chooses* to see. She knows she is good at her job and the aspects for which she is responsible. As she put it: "they can't pull anything past me!". At the same time, she admits that she is not interested in the aspects that are not her work, however, and may not even know how to carry out those other tasks or wouldn't do so very well. She only attends to that which is relevant for her, she explained: that's the only information she looks for and she can do this very well. She is good at her job because she understands what she sees, she says. She can cross reference and double check, spot discrepancies and inconsistencies, and read beyond the data entries and contextualise them. In that way, the data entries cohere and the job is done correctly. "You can see when care has gone into the work– through questions asked, details noticed, enquires made, and in exercising initiative – that's what makes your work of a high standard". The serial numbers cohere, and the details online and offline match, resulting in successful data management. Despite so much attention to detail, Ms. Wu remains uninterested in information outside of her remit, however.

Ms. Wu did not pay particular attention to the treatment cards of Xiao Zhang, but I provide this detailed description of Ms. Wu, her work, and her attitude towards her work as I find it representative of how the district CDC conceives of and carries out its role. I also offer the example of Ms. Wu as she was particularly meticulous at her job, if not a little intolerant of anything less than her standards, and she taught me a lot about the task of patient data management done well at the district level. She demonstrated care for the data and its correct management, not wanting to let discrepancies slip through unexamined. She showed me the cards that represented patients who felt like old relatives or family, and she expressed anxiety and concern when they were not handled properly. Ms. Wu clearly cares about how the patient data is managed and recorded – her position within the programme demands that she ensure that they are handled correctly – but that is not to say that she holds the same concern for the patient; that is, the actual person captured in the snapshots on the cards. In her own words, she is not interested in anything that is beyond her remit, including the circumstances or any challenges a person may be dealing with, even if these details may be inscribed on the card she receives. Ms. Wu desires that the data tally – each data point must have a value and the values should illustrate a coherent picture when considered altogether – but what the values are or why they are, are not of Ms. Wu's concern. In the story she recounted, Ms. Wu was not concerned with why the patient may still be attending hospital appointments for drugs and tests but not answering their phone or opening their door to the community doctor. That dimension is not within her remit and she wastes no time in pondering it. Rather, she is only concerned that the data is inputted and recorded accurately on the online reporting system and that the offline filing system is maintained correctly.

Ms. Wu has 'a good brain', as she puts it, and is able to quickly detect and manage discrepancies because she understands what she sees. She chooses to see as far as the data on the cards and on the computer screen and does not attend to anything beyond that threshold. This makes her work and responsibilities boxable and she is very good at managing her tasks within these limits. Within these limits, Ms. Wu deals with the patient as a serial number rather than the patient as a person in the world, and she cares about whether the data for that series of numbers are recorded and filed properly. Ms. Wu never meets any of the patients in person nor interacts with them via text or by phone. She feels familiar with the patients she manages but, in contrast with Dr. Sun, this sense has been cultivated through a familiarity with these patients' files rather than through interpersonal relationships with them. The separation between patient and public health professional here is greater, and I suggest that how district CDCs function is similar to the approach of Ms. Wu. At this level, the binary of success or failure is measured by whether a scheduled scan or

treatment task has been completed and represented by a data point entry devoid of the details of patient experience. Only certain aspects of a patient and their treatment are attended to at this level – those items listed on the A5 cards and A4 sheets. Any other considerations are precluded.

At this district level, neither Dr. Gao nor Ms. Wu deal with patients directly. Rather, Dr. Gao is made aware of patients' circumstances and challenges through the community doctor and may assist them in innovating a workaround for their patient but, again, he may never meet the patient. Moreover, with a district of patients to manage, Dr. Gao spoke to me about 'groups' and 'types' of patients rather than individuals. In contrast to Ms. Wu, Dr. Gao spoke to me about how difficult it can be for tuberculosis patients, and conversations with him and other personnel in his branch consisted of generalised reasons for why patients may or may not complete treatment – such as inadequate drugs; patients having poor understandings of health; patient's non-respect for preventative health doctors – as well as the characteristics of different types of patients. At this level, patients are conceived of using distancing nomenclature denoted by types and serial numbers, and public health professionals work to mitigate the allocation of points for community doctor performance, and the organisation and compilation of numerical data.

Municipal Stories: Numbers by District

There was no particular attention paid to Xiao Zhang's case in the municipal offices. The head of patient monitoring and the head of data management were unaware of the reasons for his refusing treatment. Dr. Gao did not inform the municipal level of the Zhang family's financial challenges, nor did he explain the document that was signed for Xiao Zhang to receive the surplus hepatic medications and waive Dr. Sun of responsibility should any negative side effects arise. When Xiao Zhang finally decided to discontinue his treatment, Dr. Qin, the head of epidemiology and data management, noted that the totals for Pudong New Area district were a figure lower that month but nothing more. At the monthly meeting for all district patient-monitoring heads (similar to the one recounted in Chapter Four), Dr. Qin reminded Pudong district that they were a figure down that month and to try to save that point. Then she moved onto the next item on the agenda and the specific case of Xiao Zhang retreated further into the municipality-wide sea of stats. At the municipal level, patients are not individuals nor even a serial number: they are a single digit within the morass of metrics. Taking a municipal-wide view, this individual and their specific circumstances are functionally invisible to those who fix their gaze on the aggregate.

Many times, I was informed that the municipal offices and its personnel are responsible for collecting data, organising trainings, and making policy recommendations to the national CDC in Beijing. They offer these recommendations based on the aggregate data they compile from every district in Shanghai and they look at the overall patterns and trends to describe the condition of Shanghai's tuberculosis situation. If we recall Dr. Qin's presentation at the monthly meeting held in the amphitheatre in the SCDC (see Chapter Four), it was the totals, and only the totals, that were of interest. She noted and called out when a district did not reach the mandated quotas or if there was missing information or documentation. In those instances, a patient's name or serial number was not called out but, rather, only the fact that there was a gap and the numerical nature of that gap; that is, how many cases were missing. Then it was the responsibility of the respective district personnel to track down and identify the serial number(s) in question and chase up the case(s) with the relevant community doctor. In contrast, this identifying information is immaterial to the municipal level personnel who are solely concerned with the health status of the municipality rather than the individuals who comprise it. Similar to the district CDC, work at the municipal level consists of the collection, collation and interpretation of metrics for all districts throughout Shanghai. Unlike the district context, however, municipal personnel are interested in the aggregate values only. Individual personal experiences and circumstances are almost indetectable at this scale and would be considered unrepresentative of how the tuberculosis control programme works on a population-wide basis.

The municipal personnel are further responsible for confirming drug-resistant infection in patients. SCDC municipal personnel from the patient-monitoring branch attend the monthly clinical consultations for confirming diagnoses of DR-TB. These sessions are held in the SPH with tuberculosis clinical heads. The SCDC director of patient monitoring is a former clinician with considerable clinical experience. He, therefore, also participates in the consultation of suspected DR-TB patients based on CT chest scans and sputum-smear results. The rest of the SCDC patient-monitoring personnel are younger and trained in epidemiology and public health only – that is to say, they do not have clinical experience – and so although they attend these meetings and present some relevant patient-management information, they are unable to participate in the clinical discussions that take place. In this environment, patients are regarded as CT scan print outs and patient files. Patient names, not serial numbers, are called out to distinguish one case from another but it is the clinical details that matter here. Although each case is examined individually, it is the disease that is assessed, not the person. Besides the location of their *hukou*, details pertaining to a patient's living conditions and personal circumstances are again immaterial in this

context. It is the clinical handling of the bacterial infection – the status of the disease – rather than the patient's experience of ongoing treatment that is under consideration. These patients are further subsumed into the category of 'DR-TB patient' or 'MDR-TB patient'; an aggregate that health professionals monitor anxiously both locally and nationally as they have watched its numbers rise consistently year after year.

The same is true in the municipal laboratories where a diagnosis of DR-TB is definitively confirmed (see Chapter Two). Two sputum samples taken from every confirmed tuberculosis patient at the point of diagnosis are sent for drug-sensitivity testing (DST) in the SCDC. Each sputum-smear specimen is labelled with a code devised by their hospital consisting of the hospital code and patient code.[99] The patient here is conceived of solely as their sputum samples, with considerations of personal living conditions and other circumstances alien within this setting. What is of importance is the *mycobacterium tuberculosis* and whether it is sensitive to the treatment antibiotics. Or put another way, whether the collected sputum samples are resistant to any of the first-line antibiotics the patient has already been prescribed. Thus, time is of the essence as the patient may be taking medications that might or might not be effective against their infection.

These personnel man the only laboratory in the municipality equipped with the technology and expertise to carry out DST. They must return a result to the hospital within one month and the binary of success or failure is measured by whether that result is useful or not – whether there is a clear confirmation of drug susceptibility or resistance in the absence of specimen contamination. Moreover, these municipal staff are responsible for ensuring that the number of DST carried out and the number of incidences of tuberculosis for the entire city cohere, which is again measured in binary. If they do not, enquires are made with district personnel, who in turn ask designated hospital laboratory technicians for the reasons why. The municipal laboratory personnel never meet patients nor even see an image of the individuals whose infective bacteria they handle, test and risk contracting infection from every day. These technicians do not recall when they handled Xiao Zhang's sputum samples, nor do they know what serial number his samples would have been labelled as. It is also certain that they do not know anything about the course of his treatment. The laboratory is the birthplace of modern medicine (Foucault 1973), where all

[99] As seen in Chapter Two, although these codes should adhere to a common format throughout the municipality, laboratory personnel complained of how each hospital composes them differently, which at times results in confusion when inputting DST data and outcomes online.

conditions are known and controlled for, the scientist remains completely objective, and subjects are fully dehumanised.

Managed through the ideologies and practices of scale, Xiao Zhang's transformation from person to distant, abstract metric is complete.

PART TWO

'SCALING-UP': OFFICIAL NARRATIVES – TRUE OR CORRECT?

Transforming patients into numbers enables the management of aggregates. As aforementioned, the issue of scale for public health is one linked to population. Its aim is to provide the most people with healthcare whilst drawing from a limited source of resources, labour and funding. In this approach to managing the health of the masses, it is not the health of the individual but rather the condition of an aggregate that is of concern. In practice, this often results in the provision of not the best care for each person but sufficient care for the most people. Individuals undergoing treatment are conceived of as part of the aggregate and are expected to conform to playing their role as the conceptual 'patient' in the step-by-step process of how the national programme ought to roll out. This imaginary of the patient is a fixed one, with little room for the fine grain of the personal when zooming out to fit the bird's eye view of the collective into the frame. Notably, a group comprised of imagined patient types is still itself an imaginary. Regardless, public health professionals have a responsibility towards this group, in contrast to clinicians who have a duty of care on a one-to-one basis towards their patients. This approach of caring for an abstraction of what is a group composed of individual persons is a fundamental issue of debate within public health.

Whereas clinicians have a direct relationship and duty of care to their patient or even 'client', to whom or what the public health professional is responsible is not so clear. Even if likened to a 'community' in lieu of a 'client', public health law professor Lawrence Gostin has raised whether it is possible for public health professionals to engage with a notion of a "vague and fragmented" (2002, 11) group with the same clarity and ethics of responsibility that clinicians or lawyers are bound by in working for the benefit of a person-in-front-of-you seeking their aid? Anthropologist Katherine Mason demonstrates how this may be possible but also difficult due to at least three fundamental differences she identifies between serving the aggregate and the person based on her work with CDC staff in south-eastern China.

First, she states that the nature of ethical engagement between public health professionals and an abstract, numerically based conception of an aggregate,

> is not grounded in the kind of one-to-one human contact and "human feelings" (人情; *renqing*) that lie at the core of any empathetic response and also serve as fundamental building blocks of Chinese sociality. (K. Mason 2016a, 17)

Although Mason names this human contact as being *renqing*, it is a core component of any instance of meaningful human engagement, within China or elsewhere. Conceiving of the entity that you serve exactly as an 'entity' categorises, distances and differentiates the public health professional from their charge. Indeed, what sense of humanity can one connect with when balancing a spreadsheet comprised of columns for conversation? Mason demonstrates in her work how her informants actively built boundaries and avoided interacting subjectively with individual patients so as to maintain their distinctiveness and relational distance from the aggregate.

Second, at the same time as pains are taken to assert what constitutes the aggregate, Mason argues that the,

> slippery edges of the [notion of the] 'community' open the door for public health professionals to be able to leave out from this category those whom they feel they cannot or should not let in. (Ibid., 18)

Again, I would add that this phenomenon takes place not only in China but also elsewhere in the world. I further state that this isn't specific to public health but can occur in any arena, including the clinical, administrative and legal. Categories preclude and exclude as well as include (e.g., Bowker and Star 2000) and it is often down to the discrepancy of the parties involved whether or not they are willing to exercise discretion (Lipsky 1980) to mitigate or even innovate workarounds (as discussed in Chapter Five and above). However, categories certainly do instate boundaries and, when those limits become obstacles to care, it is not always certain whether those obstacles will be overcome.

Finally, Mason describes how the overarching responsibility of the public health professional in China is to the state and not the patient. Chinese CDCs enact governmental policies and projects and, importantly, are funded by the state. Public health professionals therefore have a "responsibility to guard the interests of the state by governing local populations that may spread disease" (Ibid.). In practice, this means that the interests of the few may be sacrificed for the interests of the many – that "the 'patient' who is treated may not be the same as the 'patient' who receives the benefit of that treatment" (Ibid., 19) – making the personal circumstances and needs of the

individual immaterial when compared to the overall goals of the state. The ethical duty of public health professionals who occupy the position in-between state policy and the patient is, therefore, not always clear.

Imagining the Public: Populations, Crowds and Renkou

In the edited volume *Making and Unmaking Public Health in Africa* (Prince and Marsland 2014), anthropologist Rebecca Marsland ponders the question of whether public health professionals in Tanzania recognise a 'public', as defined by Habermas' concept of a citizen, that is able to "engage in 'rational-critical debate' about themselves and shape the field in which public authorities operate, while bringing to account…those in power" (Marsland 2014, 81). She argues that although such a public does in fact exist, public health professionals do not see it and instead perceive their work as being the management of 'populations' and 'crowds'. "Populations are the concern of and the product of government", writes Marsland (Ibid., 85). This concept of public health and the state's ability to manage, promote and thereby govern the behaviours of its population is an exercise of power. The state governs what the bodies of the population ought to do and be – sanitary, productive and docile. In becoming so, "These bodies have no political life; they are units – they are homogenous" (Ibid.). It is easier to count homogenous entities than heterogenous ones, and, as we have seen, the practices of scale-making categorise patients into standardised concepts. Moreover, the bodies of populations do not disagree, debate nor deviate but instead adhere to public health policy as they ought to. Doing so renders them, this aggregate, as ideal rational, predictable and responsible citizens. Unlike crowds.

Crowds are construed as being unpredictable, unreasonable and unsanitary to the point of even being backwards (Marsland 2014; Briggs and Mantini-Briggs 2003). The bodies that comprise such an aggregate are therefore dangerous and constitute a risk to the project of public health and the governing powers of the state. Unsanitary and unruly, they exhibit non-compliant behaviour and in doing so demonstrate themselves as being irrational and unreasonable. This kind of body also carries out actions out-of-sight, where the state can't see nor surveil, and thereby operates illegibly. "This illegibility often leads to an authoritarian response from public health services" (Marsland 2014 drawing on James Scott, 86), such as the practice of involuntary incarceration (discussed in Chapter Three). It is this kind of deviant citizen that the state must protect itself from. Imagined as being homogenously self-serving, irrational and irresponsible, the state must exert more control over this kind of body in order to neutralise the danger it poses by rendering it docile and compliant. The

practices of scale-making produce the types of bodies that comprise populations and crowds based on specific imaginaries of what they are and logics around how they should be managed.

Within the Chinese context, the imaginary of the 'public' has evolved from a particular history. The logics of the Maoist period have deeply influenced the significance of this concept in today's China. Immediately following victory, the Chinese Communist Party (CCP) reorganised society into the ideal of *renmin* (人民) or 'the People' and instilled the idea of complete loyalty to the CCP over any personal or familial relations that had structured Chinese society up to that point. Professor of East Asian languages and comparative literature Haiyan Lee describes how,

> The People-as-One admitted no internal division. There was no in-between and hence no possibility of genuine friendship; there was only the aesthetic intimacy of camaraderie eulogized as sublime socialist solidarity (Lee 2014, 23)

The intimate dyad of the People and the Party was bound by duty and service: it was the duty of the Party to serve the People and, in turn, the People's duty to serve the Party, and all for the sake of a socialist and utopic common good (see Chapter One) to be brought into being through practice (T. Mao 1964[1937]). Mao engaged this national resource by mobilising the 'masses' (群众; *qunzhong*), particularly through the countrywide Patriotic Health Campaigns that were widely accepted as owing their immense successes to the voluntary and dedicated efforts of the People. Mason highlights how the vestiges of mass mobilisation continued to be lauded internationally as being fundamental to China's successful containment of the SARS epidemic in the early twenty-first century. Additionally, they were subsequently praised by the CCP as a core feature of the country's ability to prepare for and deal with future outbreaks and epidemics (K. Mason 2016a, 22). Intriguingly, however, research conducted by historian Miriam Gross into the Patriotic Health Campaign for schistosomiasis comprehensively outlines how the achievements of the mobilised masses were in fact not due to the spirit of a shared socialist commitment, but rather, to the effective and oftentimes coercive methods used to compel participation (Gross 2016). Some of these methods, including financial penalties for failing to meet targets, were similar to what we continue to see in the management of public health work today (as explored in Chapter Five).

The onset of China's Reform and Opening Up period marked the beginning of change in this relationship between the People and the Party. The state began to withdraw from the funding and provision of basic aspects of citizen life such as

welfare, housing and healthcare. As described in the previous chapter, hospitals become responsible for earning the bulk of their own funding, which, in the present-day, has led to distrust between patients and health institutions and their staff, as well as the well-documented rise in patient-doctor violence, suspicion of corruption and bribery, and so on. Moreover, the state's withdrawal of service from the People has culminated in the People's withdrawal of service to the state (Cho 2013). Instead, anthropologist Mun Young Cho argues that the People serve the *renminbi* (人民币; Chinese national currency), as spurred by Deng Xiaoping's assertion that 'to get rich is glorious'. Subsequent debates such as the One-child Policy and the installation of the CDC model have crystalised the concept of 'population' or *renkou* (人口) and the ideology of managing sanitised, docile and homogenous bodies as a public health strategy. Within the Chinese context, the concepts of the People, the masses, and population intra-act in co-constituting the national public today. Which characterisation is drawn upon depends on the perspective taken and what goal is being pursued. The imaginary of crowds, comprised of non-compliant bodies that are unpredictable, illegible and unsanitary, also constitutes part of this national public, commonly evoked when referring to the large and economically indispensable 'floating population' of migrant workers (流动人口; *liudong renkou*).[100]

This 'other' population of undisciplined bodies "do not behave 'reasonably' from a public health point of view" (Marsland 2014, 84). However, as we observed in the previous section, that point of view depends on which level of the scale you cast judgement from. From the municipal level, from which policy recommendations are made, floating population patients are most certainly perceived as being unreasonable. I was informed on multiple occasions of how these 'kinds' of patients are non-compliant and heedless of authority, selfish, irresponsible and backward as they do not understand science nor hygiene and, therefore, exacerbate disease transmission. They are dishonest, sometimes going to different hospitals so as to get another diagnosis, which is not permitted, thereby further demonstrating their irrationality. They are unreliable and stop and start their medication. They are, therefore, responsible for breeding DR-TB and, worse, transmitting it to others if they are unwilling to abstain from work, wear a facemask, or isolate themselves. Moreover, they are shrouded in uncertainty as they may or may not give a correct address or telephone number, may or may not show up to appointments, and if they leave Shanghai, they may or may not reregister wherever they do move to. The issue of

[100] Although the use of *renkou* denotes the ideology of population, public health professionals perceive this migrant group as a crowd.

mobility is one that destabilises infectious disease control based upon the certainty and fixedness of protocol.[101] It renders the actions and whereabouts of these patients illegible; a terrifying prospect for institutions in today's global society that operates under 'the tyranny of light' that fetishises data and its accumulation as a form of control (Tsoukas 1997).

Correct Stories of Control, Technocratic Narratives of 'Truth'

The ability to wield control over populations and crowds, and to produce the metrics that reflect this, is therefore an indicator of China's prowess in science and technology and the CCP's power both nationally and in the global health arena. As put by anthropologist Vincanne Adams, drawing from James Scott,

> the degree to which modern governments succeed or fail depends in part on their ability to create systems of quantification that render complex social phenomena comparable and countable. (Adams 2016, 7)

As explored throughout these chapters and in the above ethnography, considerable technology and expertise are required to operationalise a tuberculosis control programme and generate the data for reporting up to the national CDC. This includes and is not limited to: the installation of an online reporting system and timely patient management; the public health and clinical training of doctors; their professionalisation to remain detached from patients and follow protocol; organised knowledge exchange whereby municipal staff are sent abroad for training or to consult; organised meetings and trainings; systemic and systematic surveillance; the carrying out of audits and evaluations; having access to BSL-3 and -4 laboratories (see Chapter Two); having the technology, equipment as well as the laboratory protocols to operate these highly technical and risky spaces; and a stable supply chain of tuberculosis antibiotics. In addition to having the second highest burden of tuberculosis globally, China's capability to control its population and be heralded as a success story for the DOTS approach[102] bolsters its official narrative of the country's standing as a moderniser. As put by a municipal officer Dr. Lu,

> China is a high-burden TB country. We have lots of skills and theories and so it should be us who are the ones informing others based on our extensive experience.

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[101] Indeed, China's Zero-Covid Policy exacted a severe control on the entire population's mobility by policing and controlling people's ability to enter or leave their own neighbourhoods, towns and cities. This was also the case of entering or leaving offices, shops or medical and educational centres, for travel between provinces, and for entering and exiting the country. It was the case for all residents in the country, regardless of *hukou* or socio-economic status.

[102] E.g., as described by the World Bank: https://www.rbfhealth.org/sites/rbf/files/RBF_FEATURE_China_TB.pdf

Anthropologist Emilio Dirlikov has written on the "destabilization of the old centers of 'the global' by drawing attention to the growing significance of the BRICS countries" (Dirlikov 2014, 2015), which are Brazil, Russia, India, China and South Africa, in terms of tuberculosis control expertise.

> BRICS countries have historically championed innovative health programs, at times going against established norms and global paradigms. While challenges to health remain, novel strategies and technologies developed in these countries could be used elsewhere. (Dirlikov 2014)

Indeed, Shanghai's role as a testbed for the designated hospital model,[103] its innovation of the treatment reimbursement scheme, and its consistently high statistical performance puts the municipality on the map as being at the forefront of tuberculosis control nationally. The metrics generated by its local machinery tell stories that contribute to China's official narrative of "national revival and global ascent" through the promise of modern science and technology (Greenhalgh and Zhang 2020, 1).

Anthropologists such as Priscilla Song (2017), and Susan Greenhalgh and Li Zhang (Greenhalgh and Zhang 2020) write of China's national and geopolitical humiliation at the hands of the technological superiority wielded by the 'West' throughout the twentieth century. Since late imperial China to the present day, science and technology have been invested with almost "omnipotent powers" to save and rejuvenate the country, with this belief being "built into the cultural DNA of the Chinese nation" (Ibid., 1). The reform period saw increased investment in science and technology as a strategy of catch-up development and modernisation. 'Scientific policymaking' (科学决策; *kexue juece*) became the political order of the day during the Deng era. This was a significant moment in development of the CCP's politics as science and politics became intertwined. The work of scientists and indeed, the purpose of science itself, was to serve the political goals of the Party, and the Party also built scientific logics and techniques into its politics (Greenhalgh 2008, 19). The seeds for technocratic governance were sewn and the CCP has been increasingly populated with 'red' scientists and engineers since the zeal of the Deng era (e.g., Andreas 2009). This approach of "more systematic, realistic and data-driven" policymaking co-produces the processes of what Greenhalgh calls the 'scientisation of politics' and the 'politicisation of science' (Greenhalgh 2008, 18). It is these twinned processes – whereby scientific truths structure the Party's political reasoning and

[103] The designated hospital model has now been implemented in most provinces throughout China. Reported low numbers of tuberculosis health professionals, lack of sufficient training, low financial incentives, and low career development opportunities leading to low levels of motivation confound the model's sustainability, however. (e.g., Z. Wang, Jiang, et al. 2019)

political truths are made empirical through making their claims through science – that drives China's technonationalist (Song 2017) official narrative both nationally and in the global health arena.

The project of global health (e.g., Biehl and Petryna 2013) also promulgates its own official narrative through its multiplicity of stakeholders, and state and non-state institutions. These global bodies operate predominantly in terms of quantification and insist on management and measurement through metrics.[104] They simultaneously practice and propagate the utility of metrics,

> to offer uniform and standardized conversation about how best to intervene, how best to conceptualize health and disease, how best to both count and be accountable, and how best to pay for it all. (Adams 2016, 5)

Metrics comprised of numbers stripped of history, context and circumstance may paint only a partial picture of a given situation and it is possible that they communicate a skewed representation as a result of their limited scope. Nonetheless, they are undoubtedly useful and do offer another perspective and dimension to understanding social issues that global health institutions prioritise.

These institutions make the quality of scalability a criterion for programmes they endorse within the "'projectified' landscapes of care" (Biehl and Petryna 2013, 6, quoting Whyte et al.) they fund and administrate. Operating on a project model means that these projects must perform well in order to receive and continue to receive funding. Failure to do so results in the ending of a project. Therefore, global health projects must generate promising data to continue to operate, and global health institutions publicise this positive progress as evidence bolstering the official narrative that justifies their own continued operation (e.g., T. Li 2007; Mitchell 2002; Ferguson 1994). The Shanghainese tuberculosis control programme no longer receives funding from global health institutions and China largely funds its own national tuberculosis programme supplemented with some global health financial support.[105,106] Nonetheless, the country must perform public health to internationally recognised standards (hence the adoption of the CDC model) and communicate in the technocratic language of metrics in order to be counted on the global stage.

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[104] For example, the WHO, the World Bank, The Global Fund, the Bill and Melinda Gates Foundation, among many more.
[105] Beginning in 2001, the Global Fund made significant contributions to China's national tuberculosis control programme. Since 2014, China has switched from recipient to donor and now ranks as the Global Fund's twentieth largest public donor and "strategic partner", collaborating on projects for HIV, tuberculosis and malaria in Africa: https://www.theglobalfund.org/en/government/profiles/china/
[106] For example, the Bill and Melinda Gates Foundation continues to fund MDR-TB programmes in China but not in Shanghai.

China is obliged to report its tuberculosis control data to institutions such as the WHO for global health statistics collation, as are all countries.[107] Having examined how these numbers and statistics are generated throughout these chapters, the obfuscating effects of data inertia, expertise inertia and scale-making confound the fidelity of these metrics as representing the realities of tuberculosis control. Moreover, the metrics that comprise reported data are the results of, out of necessity, the unstandardised (direct) observation of therapy – despite the label, the appearance of standardised DOTS having taken place is created through entangled human and non-human agencies that co-produced surveillance rather than daily DOT. This again calls into question how representative this data is of a programme premised on the core need for direct observation of patients taking their medications to ensure recovery, avoid treatment default, and avert drug resistance.

Katherine Mason has discussed the nature of data and 'truth' in her research with CDC health professionals in south-eastern China. She examines how her interlocutors are often under pressure to report 'correct' statistics rather than 'true' ones (K.A. Mason 2016b, drawing from Blaum). She describes that although the national level demands 'true' statistics, its demands are defined by the narrow predictions made by epidemiologists. Anything that deviates from these brackets can be considered as being "not scientific", "irresponsible" or "wasteful" (Ibid., 50) even if it may more accurately represent the reality of public health work. Her interlocutors were under pressure from their *lingdao* or leaders to achieve these targets, which can entail the reporting of 'correct' statistics. Not achieving these targets is to let down your *danwei*, resulting in the deduction of points and funding (as explored in Chapter Five), as well as compromising the province's performance and the nation's development (as discussed in Chapter One). Elsewhere, Mason has explored how her interlocutors manage and make sense of the multiple truths represented by the data they receive, analyse and manipulate. These include 'good-enough truths' whereby her interlocutors endeavoured to render 'correct' data more objective and scientific through proper statistical manipulation. And 'discounted truths' whereby her interlocutors estimate the 'true' or 'real' value of the data vis-à-vis the education level of whomever they received the data from (K.A. Mason 2020). There is a clear clash (Mol 2002 as discussed in Chapter Three) here between notions of what an imagined objective and scientific truth ought to be and the kind(s) of truth(s) that actually get reported when put under social, political and methodological pressure.

[107] See Appendix for the 2014 WHO-reported epidemiological metrics for China's tuberculosis rates and control effort indicators.

Anthropological research in tuberculosis control has explored this phenomenon in fieldsites around the world, including and not limited to Haiti and Russia (Farmer 2001); U.S. (Draus 2004); Nepal (e.g., Harper 2005); Georgia (Koch 2013a); South Africa (Dixon and Macdonald 2018); Vietnam (P.H. Mason et al. 2018); France (Kehr 2020); Brazil, Romania and Ghana, among other countries in this edited volume (MacDonald and Harper 2020); and India (Venkat 2021). The insistence of global health institutions on a dogged trust in numbers (Porter 1995) and the use of technocratic techniques, such as surveillance, audit cultures and scale-making, to manage and measure a profoundly social disease of inequality in a largely one-size-fits-all approach fundamentally sets up the reporting up of 'correct' data. These ethnographies have shown how this is done irrespective and even, at times, in the absence of consideration for the social, economic and political context extant (see also e.g., Biruk 2018; Merry 2016; Wendland 2010). The *maodun* that arise from these misalignments cast concern over the kinds of stories and official narratives that get told based on data generated in this way.

Such stories and official narratives include those told of the certainty of tuberculosis eradication being but a matter of time in the late twentieth century and, later, of the subsequent 're-emergence' of the disease in drug-resistant form in the 1990s. Drawing from Packard and Farmer, anthropologists Dixon and MacDonald write of how actually,

> the [global] discourse of "re-emergence" neglected the fact that TB had never disappeared in the developing world…where rates of the disease steadily rose in the decades following the discovery of antibiotics. (Dixon and Macdonald 2018, 249)

Stories of tuberculosis control derived from 'correct' data made for official narratives that did not come to pass and were not actually the case. That is not to say that the reporting of 'true' or 'real' data would have resulted in a 'truer' outcome, with 'truth' being multiple (e.g., Mol 2002), partial (e.g., Merry 2016), and contingent on perspective (e.g., Tsing 2005 and the present chapter). Rather, it is to say that echoes of the story of Xiao Zhang are detectable – how patients' experiences of tuberculosis treatment and recovery through DOTS are transformed and become indiscernible at the national and global levels. This is the nature of the data that travel up a scaled global health programme and inform the technocratic telling of China's and Global Health's official narratives.

CONCLUSION

The quality of scale-making is one expected of 'modern' health programmes. For the projects of public and global health, it allows governments to manage the health of its population rather than just that of an individual or a small group. Scale-making is therefore useful for gaining knowledge of a health landscape, measuring how an intervention is performing, and using that data to further inform health policy at scale. This chapter has attended to this essential quality to better understand how a global health programme such as DOTS functions at scale through tracing what happens to the concept of 'patient' as it ascends the Shanghai tuberculosis programme. I have explored the transformation of an individual patient into an aggregate data point by the stripping away of historical, contextual and circumstantial details that defined the patient's experience. It is these 'objective' metrics that then go on to inform policy and the official narratives of tuberculosis control and its achievements told by China and global health institutions that can shape reality.

The above ethnography has attended to the data and stories told at each level of the STP by health professionals working at the interstices. A community doctor told the tale of Xiao Zhang's personal struggle with and ultimate abandonment of his treatment; district personnel recount the fates of categories of patients and other doctors' cases as inscribed on material artefacts; and health professionals at the municipal level report the aggregate numbers for patient totals and compliance with protocol and DST results. These municipal numbers are weaved into representations of tuberculosis control reality through municipal reporting despite having been stripped down to a technocratic rendering of lived experience.

The nature of these data profoundly impacts the kinds of stories and official narratives that can and are told through them. However, the very process that makes them consumable as population data renders them thinly representative of patients' lived experience of treatment and recovery through DOTS. This *maodun* is then baked into the official narratives that are promulgated by China and global health institutions. The effects of scale-making on storytelling are, therefore, relevant for how knowledge about tuberculosis and its control is produced, promulgated and perpetuated.

Interlude: Director Mei

A Compassionate Heart

The first time I met Dir. Mei (梅), I had the pleasure of interviewing him. Dir. Mei had been director of Shanghai's Tuberculosis Department, was the director of Macau's Tuberculosis Department, and also head of the Chinese Anti-Tuberculosis Association (CATA; as discussed in Chapter One). My interlocutors had spoken glowingly of him and were clearly looking forward to seeing him that day as all were gathered for the municipal-wide friendly contest held in a district CDC.[108]

Dir. Mei demonstrated his generosity straight away by sitting down with me for almost two hours while the competition was in full swing. During this time, he recounted his personal and professional history and shared his experiences and insights in relation to medicine and tuberculosis control as matters of social concern. Dir. Mei was trained as a clinical doctor, a public health specialist, and a microbiologist (see Chapter Three for an example of his work in microbiology). He claimed that having knowledge and experience in all three areas afforded him a deep understanding of the issues at stake for the whole DOTS system. In Chapter Three, Dir. Mei attended to the microbial through his investigation of how *mycobacterium tuberculosis* infects, evolves and co-infects with multiple strains. On this day, he explained to me how his clinical and public health training had instilled moral and ethical responsibilities that he had come to understand, uphold and endeavour to enact throughout his career.

> It was the first class of medical school: to care about the patient, to have compassion [爱心; *aixin*] for the patient.[109] For a doctor, this is the very first requirement. Also, a doctor must possess a spirit of dedication [奉献精神; *fengxian jingshen*]. That is to say, you can't just think of yourself, you need to

[108] This was a teambuilding method for districts to familiarise themselves with the details of policy. There were different rounds, with districts personnel organised into teams for quickfire answers and individual representatives filling in exam-like papers to score points for their team.

[109] Anthropologists Chaoxiong Zhang and Priscilla Song have written on how *guan'ai* (关爱; care and love) "functions as politicized affection cultivated by the state" (2020, 92). Dir. Mei uses the notion of *aixin* in terms of the doctor's direct responsibility towards their patient(s) to work on their behalf rather than as a form of state control over its population. From my understanding of their analyses, aspects of Zhang and Song's observations are applicable to Dir. Mei's reasoning, such as how *guan'ai* and *aixin* both involve an asymmetrical power relation. However, the quality of self-sacrifice inherent in *aixin* fundamentally differentiates it from *guan'ai*.

think of others more. A doctor must be like a candle, casting their glow on others, illuminating everyone, burning/sacrificing themself [照亮大家，连烧自己; *zhaoliangdajia, lianshaoziji*]. A candle burns itself to let others glow. You must have that kind of energy, that kind of compassionate spirit [爱心精神; *aixin jingshen*]. So if you're the type of doctor who is always only preoccupied with making money and looking for money from patients, then there is a problem with your priorities. In university, the very first thing they taught us was that, to be a doctor, you must have two things: good medical abilities and, most importantly, you have to have a compassionate heart. That is the kind of guidance we received.

I have worked off this basis all these years. I take action for the patient. As a public health director, I address policy for the sake of the patient. Because, as you know, China was particularly poor. More recently there has been economic development and now there is support. But when I started work in the 1970s, the country's economy wasn't good and patients seeking healthcare were not financially supported. Moreover, TB is a disease of poverty. Therefore, in dealing with TB, you must bear in mind that 80% of those who contract TB are poor people. When they contract TB, it becomes very hard for them. In what way? If you develop TB you have to rest. You need nutrition; that is, you need to eat well. You must rest and you cannot [go out and] do things/work. Why? Because it's contagious. But the patient is poor. If they have no money how can they rest? How can they take in enough nutrition? And how can they take on the heavy financial burden of treating TB? And so doctors, apart from treating the patient's illness, must have compassion and consider the difficulties that patients have to deal with. Then, in doing so, how can you bring the case of their hardships to the government? Because we doctors have no ability to solve such problems on our own. They are things that the government has to solve.

It was at this point that I learned that the design of Shanghai's tuberculosis programme had been profoundly shaped by Dir. Mei's efforts. In late 2001, Dir. Mei began petitioning the government to provide free treatment to tuberculosis patients in Shanghai with a non-Shanghai *hukou* so that all those afflicted by this disease of poverty could receive financial support, particularly, those who needed it most. The city was financially well-off in the early 2000s and Dir. Mei seized the opportunity to present a report of his argument to the government. The government was not receptive, however, and rejected his proposal. He wrote and submitted five reports

and all five were rejected. Finally, the government responded that his claims of insufficient financial support for patients were unsupported by evidence. Dir. Mei then conducted two studies to fulfil this request.

> I conducted two studies in Zhabei. It was a very poor district with the highest prevalence of TB prevalence in Shanghai. The first study addressed the government's claim that it covered all costs for tuberculosis patients through its labour insurance called *laobao* [劳保]. I refuted that claim in my reports.
>
> Shanghai's health insurance is divided into two parts. In terms of healthcare costs, 50% is covered by the government. The other 50% has to be paid personally by the patient. The study showed that when patients initially have cough and phlegm, they don't immediately go to the designated TB hospital to see a doctor. They are more likely to go to the general hospital to seek treatment. The general hospital obliges them to undergo multiple examinations, checking for everything, doing x-rays and whatever else. It is during these examinations that the first 50% of government allowance is used up. So before they have even taken any medication [or received any treatment] the 50% used up. Then, when the time comes for actual treatment, the patient has to pay for the six to eight months' worth of drugs themselves. So I said to them: your policy has a flaw. Well, I submitted this evidence above and the government couldn't say anything.
>
> The second study investigated TB patients' household situation: what was their annual income? At the time in 2001, the government provided financial assistance to those who earned less than RMB 230 per month. The results of my study showed that TB patients earned even less than this cut-off point. They only earned only RMB 210 but they didn't receive any assistance. [Ting Ting: why is that?] They [the government?] didn't know why.
>
> After carrying out those two studies in response to their fifth rejection, I submitted a sixth document to the government with this information. The two studies were very quick. They took less than one month to complete because the information was all already there. It was very easy, we just took all the information and generated some statistics and that was enough. When it was all submitted above, no sound was made. So I pursued it and sent a seventh document, and then an eighth…I started the reports in 2001 and during 2002 and 2003, I didn't attend to other affairs. I concentrated on these eight reports for the sake of gaining free treatment for patients. The government

finally approved my suggestion at the end of 2003. Perhaps because I wrote in the final report that just 5 million RMB per year was enough and queried how a city as grand as Shanghai couldn't afford that. Maybe that comment angered them. Nevertheless, since 2004, Shanghai's government provides free treatment for all its TB patients.

Later, Dir. Mei and his staff also carried out a study that investigated the experiences of MDR-TB patients in Shanghai. This provided the evidence to support their petition for the free treatment of all MDR-TB patients regardless of *hukou*. They were successful and in 2012, Shanghai became the first province to provide state financial support for all MDR-TB treatment expenses for a total of RMB 60,000 per patient. With this, Dir. Mei returned to the importance of *aixin*. He explained that there is often money available for policy change but it is down to whether you can come up with how to apply for that funding. Where do such ideas come from?

If you have *aixin*, you'll have the idea. If you don't have a compassionate heart, you'll never realise the idea, even if it is there in front of you.

In my role as a doctor, I feel that it is my responsibility to think and act in this way. In everything you do, you have to think of the patient. Working in public health and prevention, you can't always think about your own problems. You have to think of the public's health problems. The citizen: how do they affect the work we do and vice versa? That's why I say, the responsibilities of the CDC are broader and wider than those of the hospital. Think about it. The hospital is only responsible for the patients who are registered and admitted there. Their responsibilities are surrounded and bordered by walls. But we [public health] have to manage beyond any walls, reaching into society. To manage that, you even more so need a compassionate heart. If you don't, you will *never* be successful. If you don't have that, if you don't sacrifice yourself to cast light on others, you won't achieve it. This is what we call 'respect'. If you respect who you are caring for, then you're respecting your own work. It's the attitude with which you do your work that is vital.

Conclusion

The voices of health professionals from across Shanghai's tuberculosis control programme have served as our guides in this thesis. Their comments have expressed a mixed chorus of pride and frustration, pragmaticism and the personal, formality and the more familiar, with compassion mediating in between. The SCDC can boast one of the best disease control performances in the country and yet, there are not enough people working in tuberculosis. Health professionals have confidence in the purpose of national health policy and yet, at times, have difficulty finding the sense in doggedly pursuing targets. They are aware of the challenges patients face that confound their ability to adhere to the demands of treatment but, out of desperation, some health professionals call for involuntary incarceration. These individuals occupy the in-between and bear witness to the ambivalent. They voice their interstitiality through these expressions of what they have seen, managed and felt.

Their ambivalence directs us towards the *maodun* or contradictions inherent in the technocratic DOTS approach to tuberculosis control. Throughout this thesis, I have explored the clashes that take place when policy is applied to the lived lives of patients in contemporary Shanghai. In these moments of 'slippage' (O' Reilly 2017), health professionals have pulled back the veil and shown us how they chose to engage with these misalignments. These exceptionally rich opportunities have afforded insights into how a technocratic health programme plays out in theory and in practice; the role of non-humans in the operationalisation of technocratic methods; and the non-human and human co-production of knowledge through this process. I have demonstrated how health professionals negotiate these moments of *maodun* to make DOTS fit for human use. I have argued that their choices and actions inform the formation of their own interstitiality and recursively make and shape the nature of tuberculosis and its control.

Non-humans play a significant role in these processes of making and shaping. Microbes, categories, concepts, protocols, standards, tools, drugs, documents (both material and digital), money (in terms of costs, reimbursements or salaries), and numbers are some of the non-humans that comprise the technocratic tuberculosis landscape and feature in this thesis. These agents saturate DOTS and are a constant presence. Examining the role played by non-humans has offered a fuller way to engage with and unpack the programme's technocratic design. Moreover, non-humans and humans intra-act in the co-production of knowledge, which can have a

profound bearing on the development of microbe-human relations and the evolution of both. This knowledge can inform stories or come to constitute 'data' or 'evidence' that bolster particular notions of reality and 'truth'. I have suggested that attending to this relationship is vital for understanding the nature of tuberculosis and its continued proliferation.

Health professionals' understandings and choices were profoundly influenced by the context in which they carry out their everyday work. Chapter One traced the historical development of public health in China and tuberculosis control in Shanghai. It further set the social, economic and political scene in contemporary Shanghai, a major metropolis that operates its own version of DOTS alongside the *hukou* system that determines, among other services, access to public health support and how much. The story of Liu Wen and her experiences of seeking medical support is a common one told by health professionals when speaking about the largest demographic of tuberculosis patients in the city: migrant workers. While they are aware of the substantial restrictions those with a non-Shanghai *hukou* are subject to, they nonetheless still express their frustrations towards the *maodun* in having to track down patients who don't want to be found and deliberately evade the system by giving false personal details. Patients may do this due to being unable to afford the medical costs they must pay upfront while not being permitted to work until they are pronounced 'cured'. At the core of this issue is the control of an airborne disease that may infect randomly but is specific in terms of who suffers symptoms – those living in poorer conditions and constricting financial circumstances. Health professionals spoke of how patients' precarious social, economic and political conditions intersect with and exacerbate the dangers posed by the infectious microbe, *mycobacterium tuberculosis*.

Chapters Two and Three sought to explore human-microbe relations and how they impinge on technocratic tuberculosis control. According to DOTS, the only way to confirm a diagnosis of tuberculosis is by sputum-smear testing and seeing the presence of *mycobacterium tuberculosis* on a slide. Chapter Two introduced the only group of people who are able to carry out this task – the laboratory technicians – and explored how human-microbe relations are formed, enacted and come to be taken for granted. I have argued that these relations are not a natural given, but rather, are learned and habituated over time and through practice based on specific concepts of what microbes are. These concepts and how they become interpreted have a bearing on how microbes are understood in relation to us and us to them. Health professionals also demonstrated how humans' ability to control microbes is indeterminate despite the lengths they go to keep the sub-visible out and 'over there'

– a *maodun* that has wider implications for disease control based on the use of military metaphors.

In Chapter Three, I further pursued this constant non-human presence in tuberculosis control – the microbe itself: *mycobacterium tuberculosis* – by examining how it is known and what it is understood to be. I explored the ways in which health professionals spoke about and acted towards the microbe and found that rather than a single entity, they referred to multiple forms of *mycobacterium tuberculosis* that behaved in varying ways. I drew on Annemarie Mol (2002) and Myra Hird (2009) in conceptualising these discrepancies as constituting a microbe multiple, whereby different microontologies can co-exist concurrently as long as enough effort is made to coordinate and distribute these different interpretations so that they do not encounter and clash. In this way, *mycobacterium tuberculosis* can be both passive and predictable, and surprising and unexpected. However, when different forms of the microbe multiple do clash, it is health professionals who must manage the *maodun* that arise.

In Chapters Four, Five and Six, I focused on another set of human-nonhuman relations and investigated the production and use of data, specifically metric data, in the making and shaping of technocratic tuberculosis control. Chapter Four addressed the technique of surveillance used to monitor patients and gather information. Only data pertaining to specifically defined categories and indicators are collected by the DOTS surveillance system. This closed-loop fosters the production of data inertia (Merry 2016) that confounds the continuous process of indicator refinement necessary for effective surveillance. I took another approach in the chapter by examining a richer source of information for tracking patient progress – their treatment reimbursement files. Health professionals who consult these material artefacts gain knowledge about patient treatment in its financial context. These files record which tuberculosis medications and tests have been carried out and when, as well as other health costs and, importantly, details of a patient's financial burden and expenditure. With tuberculosis being so closely linked to the socio-economic determinants of health and China's political *hukou* system a determining factor for access to state financial support for health care, reimbursement files are a rich source of information that situate surveillance in context rather than in inertia. It is particularly effective for showing up the *maodun* in how money is a barrier to recovery from a social disease of inequality. At the same time, the use of tools demarcates and limits what can be counted or reimbursed. They can be both useful and restrictive in ensuring and determining how things ought to be according to technocratic assumptions.

Chapter Five then continued to investigate the nature of this data and how it is collected. Wrapped up in this enquiry is the work performed by health professionals to gather this information. I argued that in addition to their work duties, many health professionals exert emotional labour (Hochschild 1983) in their everyday endeavour to assist their patients with their treatment. In doing this, they enact care for their patient to support their adherence to treatment and continued recovery, and a form of self-care for themselves to attain the points and targets demanded of them by their superiors. However, their emotional labour is rendered functionally invisible by the technocratic practice of audit culture and privileging of numbers that measures 'success' in binary terms. Moreover, the practice of audit culture means that failure to make the metrics can result in salary deductions for the whole department, binding work outcomes with financial compensation and the added pressure that comes with that pairing. This practice and its pressures produces expertise inertia (Merry 2016) that, together with data inertia, further confounds the necessary process of indicator refinement beneficial for technocratic tuberculosis control. In this chapter, health professionals voiced the daily *maodun* they face in trying to ensure that patients comply with treatment – and thus collect the data and make the metrics – when the tuberculosis control policy neglects to provide financial support for patients' hefty tuberculosis-related expenditures and everyday subsistence.

Finally, in Chapter Six, I expanded my consideration of data through an exploration of its wider significance for China and the global health project of tuberculosis control. This was a chapter on the concept of scale and the practices of scale-making that render a project modern, expert and legitimate. I examined the stories that are told by data handled at every level of Shanghai's tuberculosis control programme. I did this by tracing how the concept of 'patient' transforms as it ascends the scale – from in the community to in the municipal offices – and how health professionals understood, related to, and spoke about this concept and its significance. I have shown how the stories told at the community level of the patient as a person are not registered in the spreadsheet of aggregate data points reported 'up' to the national and global levels. History, context and circumstance are stripped away from these numbers and statistics that inform the official narratives told by China and global health institutions about tuberculosis and its control. In this way, these official narratives that inform policy design may not map onto patients' lived realities. This then, I have suggested, may render *maodun* and misalignments between policy and the lived realities of patients recursive occurrences rather than rare oversights that may have implications for the project of infectious disease eradication by technocratic means.

Exploring the interstitiality of health professionals positioned in between where policy and patients meet has afforded an opportunity to better examine these *maodun* and the influence they have over tuberculosis and its control. *Maodun*, then, are another non-human within this landscape that humans intra-act with in the making and shaping of this disease and how we respond to it. I have sought in this thesis to capture the fluid dynamism through which these intra-actions and relations flow in unfixed ways. If this is the case, then it follows that other ways of engaging, making and shaping may also be possible; ways that may smooth over *maodun* as health professionals do through their labour. Whilst my account is situated in medical anthropology and the Shanghainese experience, it contributes to wider discussions within and outwith anthropology that touch on considerations of the human and nonhuman co-production of knowledge, and the pivotal role played by individuals to exert profound influence within the larger and technocratic.

Final Reflection: The Terrain of Efficiency

Dr. Yang (杨) brought us through the side door of the huge shopping mall, glitzy and tall, with lights running all the way down. We had met earlier in a coffee shop for an interview and now, exiting the mall, he continued to speak of his experience as a community doctor. Dr. Yang no longer worked as a public health professional – the low pay and high risks had made it difficult for him to continue as one – but he still felt very passionate about tuberculosis and often offered his time to volunteer on World TB days and other awareness-raising events. I had met him at one such event and he'd been enthusiastic to help me understand tuberculosis control in Shanghai. We turned onto a busy main street with much traffic and rows of commercial shops as far as I could see. Dr. Yang asked if I had time. If so, he would show me the real Wulumuqi Road. “This, all of this fanciness, it’s not the real Wulumuqi Road. This is the nice part but over there, just a few streets away, is the real Wulumuqi Road and you will see how people there live in considerable poverty,” he said. “The inequality is inscribed into the landscape”. I gratefully accepted his offer and we walked past the metro entrance and through the revolving gate.

The loud sounds of the main road fell away as we walked into a darker, quieter lane. “These houses are even a bit newer”. Dr. Yang explained how they had been renovated but were still crowded, and how when one person gets an illness that many people can also fall sick. He pointed to a row of small, short buildings that had housed as many as fourteen patients last year. In contrast, he then turned to the bigger, taller apartment complex opposite, with its wide views of the river running through, that had

had only two patients all year. “Tuberculosis is still a social disease linked to economics, even if it infects randomly”, he stated. He explained how the houses were low and very close together. Dark and damp without much sunlight. How they all needed new paint and restoration, and that they were very easy to blow over and collapse during strong weather conditions. We walked by the night vendors. It’s illegal, but once it strikes ten pm the vendors come out and the police look away. There were multiple stalls with seats and tables. People were sitting out with others or on their own, having some supper.

We continued to walk and came to a crumbled down building site. The area was strewn with piles of broken-down rock as if after a demolition. Dr. Yang explained that the government wanted the land to build offices and bigger buildings in order to attract investors to develop and bring more money to this part of the city.[110] He explained how the people living in these very old houses were given either financial compensation or the choice of a newbuild.[111] I looked around. The crumbled rocks were on our right. I could see that a row of houses in front of us were now just a pile of stones on the ground. There was another row of houses behind them, but all the apartments were empty and with the glass taken out of the windows, except for one. The furthest one to the right. The lights were still on and I could see the silhouette of people inside. What about them, I asked. “They have yet to leave, but they will”, Dr. Yang said. “They want more money from the government, but in the end, they will be forced to move. Their belongings will be taken out of the place and they’ll have no choice.” He explained that the betterment of everyone cannot be neglected because of this one family. “The government cannot worry about the needs of each and every person”, he said. “There are just too many people. It has to do with what is better for the majority”. I nodded, and said I understood. We continued down the dark lane, with Dr. Yang pointing out which buildings were homes to the MDR-TB patients in the area.

Reflecting on the discussions explored in the preceding chapters, I realise that at the heart of a DOTS approach to tuberculosis control is its implicit tie to the concept of efficiency. Speaking through the language of metrics and operating through SOPs lends the programme authority through its links to perceived objectivity and the scientific ‘truth’ (Kuhn 1970[1962]). These numbers essentially measure efficiency –

[110] This is part of the national *chaiqian* (拆迁) or ‘demolition’ policy of urban development.

[111] These new apartments are usually located in the outskirts of the city. This is modern high-rise apartment living. Residents who are moved to these areas are separated from their communities and can feel isolated in these newly-built areas with few amenities for community and social engagement.

how much output for input – that, in technocratic logics, indicate optimal capability in planning, control and expertise. Efficiency not only enables control, but enables a measurable way to assess control (Alexander 2008). Bound up in the concept of efficiency are the wider vision (or epidemiological imaginaries (Reubi 2020) and technocratic methods for realising its aspirations. These visions and imaginaries are brought about through ways of observing and ordering reality anchored in a particular interpretation of the world – a technocratic one. This thesis has explored how the assumptions to which that interpretation is moored do not always cohere with lived reality. When this happens, there is *maodun*.

Human-microbe relations are learned through habituation rather than being a natural given (Chapter Two); the very object of tuberculosis control's purpose, *mycobacterium tuberculosis*, is not a singular entity but multiple (Chapter Three); access to drugs should be sufficient for treatment and recovery, although it is not, and non-compliance is deviance (Chapter Four); strict auditing of health professionals' adherence to protocol should ensure gold-standard tuberculosis control, when it is the extra emotional labour and exercised discretion that make the difference (Chapter Five); and that concepts and data can remain unchanged regardless of space or time or even scale, when they, in fact, undergo profound transformation (Chapter Six). I am struck by how these tenets fundamental to the design and operation of DOTS are not certainties but, rather, just one of many possible interpretations of reality and how things work. However, through its claims to the objective and scientific, and its endorsement by institutions and governmental backing, this singular interpretation is represented as fact, with the predictions it makes then defining success or failure in the world. These definitions are supposed to form the basis for reduced DR-TB globally and the eradication of tuberculosis. The same statistics show how this has not been the case.

Efficiency provides a measurable way to assess control born from the idea that human rationality is such that it can intervene in social phenomena and reap the outcomes it desires. Intrinsic to this modern assumption is the capability of humans to comprehend the world and the "belief that the world itself [does] indeed correspond to the categories and methods of human comprehension" (Alexander 2008, 165). According to technocratic orthodoxy, misaligned material conditions that can influence outcomes are written off as distractors from the mission of gaining efficient results from limited input. Chapter Six outlined the profound transformation the concept of patient undergoes through the practices of scale-making that make for efficient and generalisable global health programmes. It is an example of the moral value of efficiency that, at once, celebrates and decries what it considers necessary

exploitation for the betterment of the many. Far from being objective and apolitical, that which is desired is laden with values and moral assumptions that assert it as being desirable.

The twinned properties of efficiency as being beneficial and a "powerful tool of repression" that can cause "deep hurts" (Alexander 2008, 167) has therefore been at the heart of this writing. In these pages, I have explored how, in the name of efficiency, entities are robbed of their dynamism and rendered static; people are made into abstractions; health professionals are punished for (not) exerting emotional labour and (not) following protocol; data get stripped of vital detail; data are falsified; and judgement – both positive and condemning – gets cast according to unquestioned norms and assumptions. The robustness of the technocratic model to withstand such incongruencies is another property of the paradigm's continuous production of its own truth (e.g., Carr and Lempert 2016; Jasanoff 2004; Kuhn 1970[1962]).

I recognise that the global health DOTS programme has made considerable achievements since its inception at the end of the twentieth century. It was devised and designed by those who desired to assist patients with procuring appropriate pharmacological treatment, to assist health professionals with standardised treatment options in lieu of having to experiment, and that tuberculosis not be permitted to terrorise the vulnerable. These aspirations have helped millions globally since that time. My research documents the 'other' effects the measurement of control and efficiency, including those of cost-efficiency, has had on patients, health professionals, and the Shanghainese tuberculosis programme. By setting standards based on its interpretation of reality, technocratic tuberculosis control sets the limits of its own achievements. Its strict insistence on adherence in one form only makes data and expertise inertia inevitable and indicator refinement impossible. The tight grip of control squeezes out the indeterminacy inherent to the nature of science itself and the messiness of lived reality. It is in these spaces of indeterminacy that *mycobacterium tuberculosis* experiments in microbe-human relations and refines its resistance to antibiotic drug treatment. With DR-TB and the possibility of relapse and/or contracting two different strains at once, as elucidated by Dir. Mei (Chapter Three), DOTS' promise of cure is exactly that: "like all promises, [it] can be broken" (Venkat 2018, 477).

These reflections compel images from my walk through Wulumuqi Road with Dr. Yang to come to mind. It was during the early days of my fieldwork and it's only now that I realise how much it represented of what I was to become curious and care

about in writing this thesis. The inequality of tuberculosis infection was inscribed into the city landscape and explicit for all to see. The airborne and indiscriminatory nature of the disease had taken sides – anyone could contract it but those better off are less likely to become symptomatic and more likely to recover. The indeterminacy of social life that doesn't follow the rules becomes clearly visible, as well as the discretion that's exercised in a dark residential laneway away from the 'tyranny of light' (Tsoukas 1997). The country's mandate to modernise and improve the lives of *renmin* (人民; the People) means the demolition and displacement of residents to areas outside the city where they have no social connections or sense of community life. This process is sometimes fraught with resistance, protest and even violence (e.g., C. Li, Wang, and Day 2021; Ho 2013). The government's planning has improved the living conditions of millions of Chinese citizens, which is necessary for a modern country and a healthy population. And yet, the needs of those in a lone lit window have no standing against the pronouncements of nationwide technocratic development. Health professionals walk through this terrain daily. Here, on this ground, they deal with the ambivalences of efficiency and come to embody the interstices where policy and patients meet and become lived reality.

CODA

The Covid-19 pandemic has presented an unprecedented opportunity to observe China's staunch dedication to scientific and technological logics. These measures were introduced after I had concluded the research for this thesis and now, as I come to the end of this dissertation, the pandemic has been heralded as all but over. I have directly experienced the effects of this staunch dedication, having lived in Shanghai throughout the pandemic for a period of almost three years and contending with the quotidian demands made by the 'Dynamic Covid-zero' policy for fifteen months.[112] That experience has imprinted upon me a multifaceted awareness of technocratic public health control, its limits, and what can be when those limits are extended to their extreme. It has no doubt informed my exploration and analyses of these logics and limits in this thesis.

From March 2020 to April 2022, life in Shanghai continued relatively unchanged. Following an initial three weeks of lockdown from January to February 2020, incidences of covid infections had remained low and mostly clustered at the

[112] https://weekly.chinacdc.cn/en/article/doi/10.46234/ccdcw2022.015

borders of the city: that is, at the international border located in Pudong Airport and the local border running along the outermost districts of Shanghai. We 'inside' in the country could feel the bubble of China that kept the 'outside' world at bay and us within it, unable to leave.[113] From within,[114] we looked out through the bubble for two years as the rest of the world struggled with multiple lockdowns and covid measures amidst political and social fracturing. In daily life, facemasks were worn by some but not all and there were no requirements to do so except in specific spaces like hospitals. Social distancing did not exist. This all changed drastically with the arrival of the Omicron strain of Sars-CoV2 in January 2022, which shook Shanghai out of its, by that stage, almost complacent bliss.

Following two months of severe municipal-wide lockdown,[115] which I am unable to write about in detail here, we were released to find a city of supreme surveillance. Constant monitoring of the population was enabled by mobile phone global positioning system (GPS) and mandatory QR code scanning for entry into any and all public, residential, medical, educational and governmental spaces. This obligated the frequent and what seemed like unending PCR testing: every seventy-two hours to go to the supermarket; every forty-eight hours to take the metro to work; every forty-eight hours to visit a family member living in another compound; and a twenty-four-hour test result to visit a doctor. Even travelling outside of the city to another province entailed weeks of quarantine at the other end and multiple testing requirements. This supreme surveillance had, by that stage, been adopted nationally and human mobility was stunted all over the country. We were tied to our mobile phones that kept our testing records and proof of being covid-free.[116]

In this new Shanghai, a grid of testing booths had been installed throughout the city of over 6,000 km^2. The government had announced that the booths were positioned so that everyone was but a ten-minute walk from one. This was to facilitate the new surveillance requirements: we had to take a PCR test every three days or our

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[113] Many Chinese citizens had their passports confiscated at the airport or were not reissued new ones in order to deter travel during the *yiqing* (疫情; epidemic) period. Only those with Chinese citizenship outside of China could enter the country, which meant that foreigners who left were not permitted re-entry. Later, foreigners already holding a working visa could return to China but no new visas have been issued until recently. This has meant that overseas Chinese who have renounced their Chinese citizenship have not been able to and continue to be unable to see their family within China.

[114] I found resonance in this with my experience of being in a BSL-3 laboratory (see Chapter Two, Scene Two: Close Encounters).

[115] Prior to lockdown, clinical health professionals in Shanghai and SCDC staff had publicly stated that having a Covid infection was similar to having the flu and questioned the necessity of these control measures. They were swiftly silenced and told to concentrate on the task of achieving Covid-zero.

[116] This caused constant *maodun* for older adults that didn't have a mobile phone, didn't have mobile internet nor WIFI at home, who couldn't keep up with the constant software changes that this supreme surveillance necessitated, amongst other issues.

QR code would turn from green to orange. An orange QR was a warning that on day seven, our code would turn red if we failed to comply with testing regulations. A red QR branded one as infected with covid and no further testing was permitted to confirm or disconfirm infection. Immediate arrangements would then be made to transport the individual to a makeshift hospital or *fangcang yiyuan* (方舱医院) for at least a week or until they tested negative.[117] This was the case even if the person had not been outside of their home in those seven days, as was often the case with elderly citizens and others who didn't need to take public transport or frequent public venues.

For a sense of what this meant in practice, I recall a scene between an older lady and a health professional clad in PPE in the forty-degree heat by a testing booth. The lady's QR had turned red due to her not having taken a test for seven days and now she and those she lived with would have to go to *fangcang*. She argued that she hadn't been outside at all, that she always wore a facemask, and disinfected everything that came in through her front door. The health professional repeated that her hands were tied because, according to the online system, she now possessed a red QR and was classified as infected. The only way to clear her red status was a negative PCR test after one week in *fangcang*. The older lady was thus faced with being unable to make her medical appointment for cardiac treatment the next day (the reason why she was taking a PCR test that day) and she and her family would instead be sent to a centre for confirmed covid infections where she would likely contract the disease. A loud argument ensued.[118]

The above is just one example of the multitudinous *maodun* that arose throughout the dynamic covid-zero policy. Those fifteen months normalised the isolating and quarantining of infected and potential hosts, unending and intensive testing, criminalisation of non-compliance, mass city-wide lockdowns of the tens of millions, constant monitoring of infection and recovery rates nationwide, the creation of new categories and ways of counting to convey a message of control over formidable epidemic spread. This time, I didn't get to accompany and interview health professionals as they held the pandemic front for three years. I did volunteer during

[117] The *fangcang* hospitals were dreaded spaces during this time. Declared specialist spaces for recovery from Covid, they primarily functioned to control disease spread by isolating those infected from the uninfected. The impromptu facilities were inadequate for the sudden flood of tens of thousands of patients and there were insufficient health professionals to manage and provide services. Most health professionals were occupied with the battle in the streets at this time, identifying positive patients and enforcing their transfer to *fangcang*.

[118] This requirement soon proved impractical and the Shanghainese government experimented with different ways to maintain compliance.

the lockdown however,[119] and after we were released, I was frequently unsettled by seeing the exhausted and vacant eyes of health professionals carrying out the assembly-line work of PCR testing. They persisted in this work standing for hours in full PPE either inside the prefabricated booths or outside on the street to scan our QR codes, even in forty-plus degree heat, as we queued in long lines for yet another test. A large amount of public health resources had been dedicated to pursuing zero-Covid, including clinical, preventative and laboratory personnel, and there was a backlog of inpatient procedures and reduction in outpatient services as hospitals operated strict Covid-19 control.[120] As a resident in the city bearing witness to our collective experience of this Shanghai of supreme surveillance, what had become the quotidian grew harder and harder to understand as time went on.

The government justified these measures by staking their necessity in the scientific and epidemiological. It also professed the strength of the nation through its ability to enact these measures for the sake and safety of its people and indicated to how other countries were less capable and/or unwilling to make the same sacrifices. Other countries' lack of the same action demonstrated how irrational they were in comparison whilst simultaneously lauding China's supreme scientific prowess and ability. This pride was further fought out through the political battle of vaccine development and China's refusal to allow the use of 'foreign' ones; a battle that is still ongoing. China's much lower statistics for infections and deaths due to covid were given as supporting proof of the correctness of governance guided by *kexue* (科学; science).

In early December 2022, the Dynamic Covid-zero policy was suddenly abandoned. Official messaging quickly maintained the *kexue* rationale with experts stating that the nation's dedicated protection of its people for almost three years has

[119] Shanghai's sudden lockdown meant that we could not leave our compounds and were advised to stay in our apartments. Volunteers were needed to carry out the everyday work of registering, disinfecting, distributing government food packages, and policing that residents remained in their apartments. We worked with the neighborhood committee to coordinate residents for compulsory PCR testing, noting who had lined up and seeking out those who had not shown up for their test. This was an intense experience fraught with local politics within the compound. It further helped me to understand the exceedingly difficult position occupied by the neighbourhood committee who were the grassroots interface between residents and the government.

[120] As stated by Pai et al., "The Covid-19 pandemic has had devastating effects on every aspect of global health, but tuberculosis services have been disproportionately affected." (Pai, Kasaeva, and Swaminathan 2022, 1490). In 2021, 10.6 million new cases of tuberculosis were diagnosed. That was 4.5% more than in 2020 and has marked the first time global tuberculosis incidence rates have increased in 20 years (WHO 2022). In China, research on the effects of the pandemic on tuberculosis control mainly concentrate on the 2020 period. However, epidemiological projections do predict medium and long-term effects (Ding et al. 2021, see in particular 4649) and research from poorer provinces, that have since experienced greater frequency of lockdowns and economic disruption, warn of substantial adverse impact (X. Wang et al. 2021).

rendered the virus no worse than the mere flu and no longer dangerous. These statements upheld the CCP's claims of correctness and the validity of their rule. A flash tsunami of mass infection immediately followed. Within 2 weeks, 70% of Shanghai residents had become infected. Basic medications like paracetamol and ibuprofen were sold out in pharmacies and hospitals and had become hard to come by. Health professionals were ordered to persevere through their own infections and fevers to attend to the heaving sea of covid patients seeking oxygen and care for co-morbidities. Omicron swept through the country in just a month. Widespread death went underreported, and I recall the ceaseless sound of coughing and heaviness of battle fatigue that saturated Shanghai's streets.

By mid-February, people had begun to discuss how "now that we've all had covid and recovered, they [the government] have achieved Covid-zero after all!". This statement was uttered with irony as the coveted zero was achieved with the abandonment of the policy. There was no official mention of the large-scale protests that took place all over the country that instigated the overturn of the policy. Informally, however, there have been rumblings of discontent with how the epidemic has been handled but these are also censored online or only shared privately amongst citizens. China has now declared the Covid-19 pandemic officially over, attributing this triumph to its technocratic handling of the crisis, guided by the CCP. This discourse absorbs any previous *maodun* and misalignments by staking the current reduced threat from the virus in their expert capability in the scientific and technological. Shanghai's health professionals have breathed a sigh of relief, I imagine, and now must attend to the task of recovering what public health ground has been lost due to technocratic Covid-19 control.

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Appendix

2014 WHO-reported Epidemiological Metrics for China's Tuberculosis Rates and Control Efforts (WHO 2015, 129).

China ■ Population 2014 **1 369 million**

Estimates of TB burden[a] 2014

	NUMBER (thousands)	RATE (per 100 000 population)
Mortality (excludes HIV+TB)	38 (37–40)	2.8 (2.7–2.9)
Mortality (HIV+TB only)	0.7 (0.53–0.9)	0.05 (0.04–0.07)
Prevalence (includes HIV+TB)	1 200 (1 100–1 400)	89 (78–102)
Incidence (includes HIV+TB)	930 (860–1 000)	68 (63–73)
Incidence (HIV+TB only)	13 (11–16)	0.98 (0.79–1.2)
Case detection, all forms (%)	88 (82–95)	

Estimates of MDR-TB burden[a] 2014

	NEW	RETREATMENT
% of TB cases with MDR-TB	5.7 (4.5–7)	26 (22–30)
MDR-TB cases among notified pulmonary TB cases	43 000 (34 000–53 000)	8 200 (6 900–9 500)

TB case notifications 2014

	NEW[b]	RELAPSE
Pulmonary, bacteriologically confirmed	235 704	25 125
Pulmonary, clinically diagnosed	526 106	
Extrapulmonary	32 348	

Total new and relapse	**819 283**
Previously treated, excluding relapses	6 872
Total cases notified	**826 155**

Among 819 283 new and relapse cases:
4 164 (<1%) cases aged under 15 years; male:female ratio: 2.3

Reported cases of RR-/MDR-TB 2014

	NEW	RETREATMENT	TOTAL[b]
Cases tested for RR-/MDR-TB	45 664 (19%)	17 210 (54%)	62 874
Laboratory-confirmed RR-/MDR-TB cases			5 807
Patients started on MDR-TB treatment[c]			2 846

TB/HIV 2014

	NUMBER	(%)
TB patients with known HIV status	343 515	(42)
HIV-positive TB patients	5 309	(2)
HIV-positive TB patients on co-trimoxazole preventive therapy (CPT)		
HIV-positive TB patients on antiretroviral therapy (ART)	3 675	(69)
HIV-positive people screened for TB	423 254	
HIV-positive people provided with IPT		

Treatment success rate and cohort size

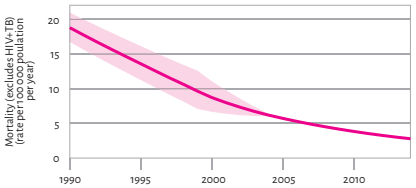
	(%)	COHORT
New and relapse cases registered in 2013	(95)	841 999
Previously treated cases, excluding relapse, registered in 2013	(90)	7 847
HIV-positive TB cases, all types, registered in 2013	(82)	4 649
RR-/MDR-TB cases started on second-line treatment in 2012	(42)	1 906
XDR-TB cases started on second-line treatment in 2012	(13)	115

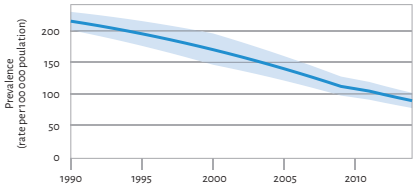
Laboratories 2014

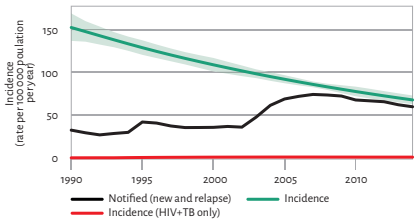
Smear (per 100 000 population)	0.2
Culture (per 5 million population)	6.7
Drug susceptibility testing (per 5 million population)	1.5
Sites performing Xpert MTB/RIF	654
Is second-line drug susceptibility testing available?	Yes, in country

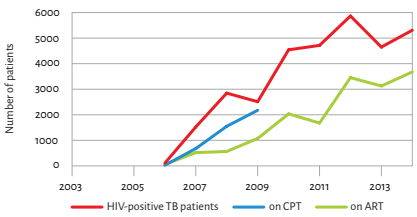
Financing TB control 2015

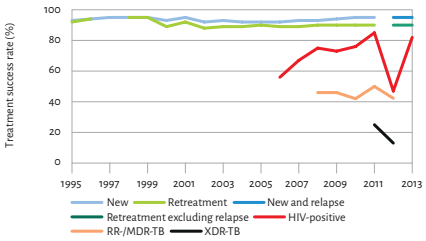
National TB programme budget (US$ millions)	340
% Funded domestically	90%
% Funded internationally	2%
% Unfunded	8%

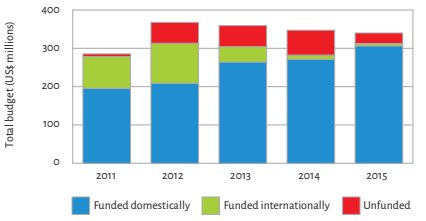












Data are as reported to WHO. Estimates of TB and MDR-TB burden are produced by WHO in consultation with countries.
[a] Ranges represent uncertainty intervals.
[b] Includes cases with unknown previous TB treatment history.
[c] Includes patients diagnosed before 2014 and patients who were not laboratory-confirmed as having RR-/MDR-TB.

Data for all years can be downloaded from www.who.int/tb/data