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**Intergenerational transmission of mental health:
The mediating effects of offspring self-esteem
and attachment**

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Thesis Abstract

Depression and anxiety are prevalent and disabling psychological disorders for individuals and the community according to the World Health Organisation. More and more research has discovered that these disorders can be passed down from one generation to another, particularly from mothers to their children. However, more studies are needed to look at the mechanisms or mediators of the transmission processes as time goes by, including how modifiable factors such as child self-esteem and attachment can mediate transmissions. This direction is beneficial for understanding what factor is important for the disorder's transmission and can potentially help to 'break the chain' of transmission.

This thesis utilises data from the Millennium Cohort Study to explore how maternal psychological disorders' impact at early childhood on a child's mental health and wellbeing at late adolescence. It applies mediation analysis and path analysis to estimate to what extent maternal impacts on children indirectly through the child's self-esteem and attachment at early adolescence. The study controls for several potential confounders, including child gender, child baseline mental health at ages 3 and 14, paternal psychological distress, maternal ethnicity, education, age of birth, alcohol usage, and family socioeconomic status.

This thesis observed positive associations between poorer maternal mental health conditions and greater child mental health symptoms. In addition, child self-esteem and attachment at early adolescence partially mediated the associations between maternal mental health and child mental health. The strength of all the associations effects decreased after gradually adjusting for confounding variables, and all the mediated associations were non-significant when adjusting for all confounding variables.

This thesis provides improved evidence that maternal psychological distress can pass onto the child, and that self-esteem and attachment are

important mediators of the transmission. Understanding the transmission process across time provides targets for psychological interventions of patients who were affected by the mental health of their mothers.

Thesis lay summary

Research has demonstrated that mental health conditions, including depression and anxiety, can be passed from one generation to the next. However, research about the mechanisms of transmission is still at an early stage. This thesis used longitudinal cohort data to explore associations between maternal mental health conditions during the early childhood period and offspring's mental health conditions and psychological wellbeing in late adolescence. It also evaluated the mediating effects of child self-esteem and child's relationship with parents (named as attachment in this thesis) in early adolescence.

Previous studies have explored mental health transmissions from mothers to offspring and identified that maternal depression and anxiety symptoms are associated with offspring's higher severity of similar symptoms in adolescence and adulthood. Meanwhile, they have also observed the associations between maternal mental health conditions and lower child self-esteem and worse child attachment, and both of them are associated with more severe symptoms of child's mental health conditions. However, very few studies have linked them together and examined the mediating effects of child self-esteem and attachment on the mental health transmission from mother to children.

Research chapter 1 evaluates how maternal psychological distress in early childhood (child's age of 9 months) is associated with child psychological distress, psychological wellbeing, internalising problems, and externalising problems in late adolescence (age of 17 years). It also examines how child self-esteem in early adolescence (age of 14 years) mediates the associations between the exposure variable and the outcome variables. The findings suggested that there are significant associations between higher maternal psychological distress and higher severity of child psychological distress, internalising problems, externalising problems, and lower psychological wellbeing. These associations were partially mediated by child self-esteem.

The research chapter 2 expands on research chapter 1 by exploring the associations between maternal emotional instability and anxiety symptoms in early childhood and child depression and anxiety in late adolescence. It adds child attachment in early adolescence to test how child self-esteem and attachment mediate the associations between exposure and outcome variables. the findings observed positive associations between maternal mental health conditions and child mental health conditions, and both child self-esteem and child attachment partially mediated the associations.

This thesis sheds light on the intergenerational transmission of mental health and, specifically, underscores the mediating roles of child self-esteem and child attachment. Ultimately, this work provides implications for future mental health research and mental ill-health prevention and interventions which I discuss throughout this thesis.

Declaration of Originality

I declare that this thesis is my own composition and that it has not been submitted for any other degree or professional qualification at this university or any other institutions.

Singed: 于博洋

Date: 29/September/2023

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General Introduction

Mental ill-health is a global concern, with 1 in 8 people globally having at least one mental health condition (WHO, 2023b). Around 1 in 7 adolescents, aged from 10 to 19 years, experiences at least one psychological disorder, which accounts for 13% of the adolescent's total disease burden globally (WHO, 2023c). Depression, anxiety, and behavioural problems are the top three conditions of illness and disability among adolescents (WHO, 2023c). Suffering from a mental disorder early in life is associated with adolescents' emotional distress, low psychological wellbeing, and low life quality (Schlack et al., 2021), and other disadvantages including leaving education early and a low rate of employment (Gariépy et al., 2022). Furthermore, many people living in mental health conditions go on encounter lower employment, high disability rates, and high healthcare costs (Parliament, 2017). Therefore, understanding adolescents' mental health issues is very important and beneficial for both individuals and the community.

Many years of extensive research have examined the transmission of mental ill-health from one generation to another – i.e., intergenerational transmission. Studies have observed positive associations between poorer maternal mental health conditions and offspring's development of psychiatric symptoms (Augustijn, 2022; Hammen, Shih, et al., 2004; Letourneau et al., 2019; Loeber et al., 2009). In addition, adolescence is a sensitive period for mental health development; stressors experienced during this period can have very strong and long-lasting impacts on adolescent mental health development (Blakemore & Mills, 2014; Fuhrmann et al., 2015; Knudsen, 2004). However, either mental health intergenerational transmission or the mental health conditions involved, such as depression or anxiety, are overarching terminologies encompassing many factors that affect mental health conditions' onset, symptoms, development, and transmission (Creswell et al., 2011; Gotlib

& Joormann, 2010; Morris et al., 2007). Therefore, it is necessary to explore specific mechanisms or risk factors of transmission to obtain a better understanding of mental health transmission within families and to identify opportunities for improved interventions and preventions.

Researchers so far have observed that a child's low self-esteem is associated with worse mental health outcomes (Orth et al., 2008). Studies have also found that negative interactions between child and parent can also predict child mental ill-health (Hammen, Brennan, et al., 2004). Here, negative interactions can refer to parents' harsh parenting behaviours when caring for their children and/or having family discord between child and parent in the long term. Previous studies have also found that maternal mental health conditions are associated with low self-esteem and more harsh parenting behaviours (Hammen, Brennan, et al., 2004; Hosogi et al., 2012; Zhou & Li, 2022). However, very few studies have linked the three factors together to examine how maternal mental ill-health can influence children's mental health, and the mediating effects of children's self-esteem and attachment. The current thesis aims to address these research gaps.

Thesis aims and objectives.

The core aim of the thesis is to explore the intergenerational transmission of mental health from mother to offspring. To break that down, this thesis has three main objectives:

- 1) What are the associations between maternal mental health conditions at the child's early childhood and child mental health and wellbeing in late adolescence?
- 2) Are these transmission effects mediated by child self-esteem at child's early adolescence?
- 3) Are these transmission effects mediated by child attachment at child's early adolescence?

To achieve these objectives, this thesis will use a longitudinal cohort study with

multiple measurements for maternal and child mental health. Mediation analyses will be used to examine the mediating effects.

Thesis structure

This thesis is structured as follows: the next section will present a literature review that discusses the existing research about mental health transmission within families. It will also discuss the role of self-esteem and child attachment on child and adolescent mental health, and how they are influenced by maternal mental health. This thesis consists of two research chapters. The first chapter follows the literature review and explores the associations between maternal psychological distress at a child's early childhood and child psychological distress, wellbeing, internalising, and externalising problems in late adolescence. It will also explore the mediating effects of a child's self-esteem in early adolescence on each transmission model. Following that, chapter two will expand on chapter one by exploring the transmission effects of maternal emotional stability and maternal anxiety to child depression and anxiety. Chapter two will also add another mediator, child attachment in early adolescence, to evaluate how child attachment and self-esteem mediate each transmission model. Following this, I will summarise my findings and discuss how my findings fit in with the wider literature in this area and I will discuss the implications of my findings.

Literature Review

Introduction

Youth mental health problems are becoming more and more prevalent. In England, 18% of individuals aged 7-16 years old children and 22% of individuals aged 17-24 years old population have at least one mental health condition (NHS Digital, 2022). Globally, mental ill-health exists in one-seventh of the populations aged 10-19 years old population (defined as adolescence period), with depression and anxiety as the most common disorders (WHO, 2022). Depressive disorder or depression, according to the most updated diagnostic information, refers to a consistent depressive feeling and a remarkable decrease of interest towards activities that were enjoyable in the past (American Psychological Association, 2013). Generalised anxiety disorder, as one of the most prevalent anxiety disorders, is described as excessive worry and anxiety happening on most days, accompanied by restlessness, irritability and sleep disturbance (American Psychiatric Association, 2013). Putting the two together, many studies have found that anxiety and depression are highly comorbid (e.g., Aina & Susman, 2006; Bandelow & Michaelis, 2015; Lamers et al., 2011), with a lifetime anxiety comorbidity rate of 75% for depression patients and depression comorbidity rate of 81% in anxiety patients (Lamers et al., 2011). Similar comorbidity results were found in the children and adolescents group (ages range from 3 years to 18 years), with up to 61.9% of children with anxiety or depression showing comorbidity of the two disorders (Brady & Kendall, 1992; Cummings et al., 2014). The two disorders, either alone or comorbid, can produce huge psychological distress and negative impacts on an individual's life, including poorer job and school performance, lower quality of relationships (NIMH, 2021) and long-term medical conditions (Patten et al., 2008).

Decades of research have shown that depression and anxiety run between generations. Offspring with one or two depressed parents are three to six times

more likely to have depression compared with offspring without depressed parents (Lieb et al., 2002). Similarly, a higher ratio of developing anxiety disorder was found among children with a parent with anxiety disorder symptoms compared with children with non-anxious parents (Micco et al., 2009). There are genetic contributions to offspring risk that start prenatally. After controlling for maternal postnatal depression, maternal antenatal depression accounts for offspring's higher risk of developing depression (Pearson, Evans, et al., 2013)). Other than genetic impacts, environmental factors also contribute to the transmission of depression and anxiety, including maternal cognitive style (Pearson, Fernyhough, et al., 2013), family discord (Hammen, Brennan, et al., 2004), other specific symptoms, such as worry and avoidance (Aktar et al., 2017), and family relations (Culpin et al., 2020). Therefore, many studies agree that the transmission of mental health consists of both genetic and environmental factors.

This review concentrates on the environmental transmission of depression and anxiety from mothers to children. Because of the significance and potentially modifiable nature of the environmental factors, more research about what can be done to help reduce the environmental risk factors and provide opportunities for more effective mental health interventions.

Traditionally, mothers act as the main carer for children, including dedicating more time and energy to interacting with children (Bianchi, 2000; Raley et al., 2012). This role creates a highly frequent interaction environment between mothers and children, and this close connection can make maternal mental health, emotion, and behaviour important for affecting child mental health. In this case, compared with paternal mental health, maternal depression produces higher risks than paternal depression (Rajyaguru et al., 2021). In terms of anxiety, previous research has shown that only maternal worry significantly predicts child anxiety, neither paternal worry nor paternal anxious rearing behaviours appear to predict child anxiety (Zhou & Li, 2022). By contrast, paternal worry only showed effectiveness through maternal anxious-rearing

behaviours' mediation. On the other hand, one previous study compared the effects of family therapy targeting both mother and child depression and anxiety and showed that both mother and child symptoms were significantly improved when interventions happened within the family (Weaver et al., 2013). This outcome suggests that taking the importance of mother-child interactions into consideration can have more efficient effects for treatment. Thus, exploring mental health transmission from mother to child will be a focus of this thesis because it would be beneficial for understanding and intervening in youth mental health problems from the family level.

Previous studies have identified several pathways contributing to the transmission processes. In this review, three pathways will be introduced, namely maternal emotion, attachment, and child self-esteem. Maternal mental ill-health negatively impact mothers' short- and long-term emotion, including having more low mood or worry (Augustijn, 2022). These negative emotions can directly transmit to children's short and long-term similar emotional problems and could reduce children's mental wellbeing (Augustijn, 2022). In addition, maternal mental illness is associated with family discord and a more stressful family environment (Hammen, Brennan, et al., 2004). These are themselves risks for children having insecure attachment, e.g., through negative family members' interactions and harsh parenting (Leinonen et al., 2003). In this thesis, attachment does not refer to Bowlby's (1982) attachment theory, but to the quality of family relationships, the parenting behaviours, and child's feeling of closeness with mother. Insecure attachment means that the relationship between the child and the primary caregiver is not emotionally close and satisfying (Cassidy & Shaver, 2016).

Self-esteem quickly develops through childhood and adolescence. Self-esteem refers to the view that a person has of themselves (Hosogi et al., 2012). High self-esteem means that a person has a positive self-view, which encourages self-acceptance and capabilities to manage emotions and stressful events (Hartup, 1983). Having high self-esteem not only means that a person

has a good view of self, but it is also associated with better mental health and psychological wellbeing (Hosogi et al., 2012). Therefore, understanding how maternal mental health impacts adolescents' self-esteem development and how this influences their mental health is a very important topic in mental health transmission.

This review aims to discuss previous studies on the impact of maternal mental health on maternal emotion and family environment, and how they contribute to a child's mental health and self-esteem development. It will provide a deeper examination of potential transmission mechanisms and offer insights into further study and intervention. Understanding mental health intergenerational transmission is an essential component for researchers and practitioners to discover opportunities to prevent psychological disorders and to reduce the impact of maternal mental ill-health's influence on child mental health development. In addition, previous studies have identified several confounders and moderators that likely impact the results, the most frequently investigated factors include paternal mental health, the offspring's gender, and the family's socio-economic status (SES). This review will discuss these factors in each section.

This review is structured as follows: the first section will briefly summarise studies related to maternal mental disorders' impact on maternal short- and long-term emotion and how these negatively impact children's emotions, mental disorders, and lower psychological wellbeing. The second section will change the focus on child attachment to look at how family environment, mother-child interactions, and maternal parenting style impact children's mental health. The third section will focus on how maternal mental health conditions impact children's self-esteem and mental health. Fourth, a discussion section will demonstrate what we have learnt so far, what needs further research, its implications, and what the rest of this thesis will do based on the current review.

Emotional pathway of mental health transmission

To illustrate the importance of emotion on transgenerational mental health, Pasarelu et al (2015) investigated transmission of anxiety disorder by using 87 groups of mothers and children. They found a significant association between maternal and offspring anxiety disorder, but suggested this was fully mediated by maternal and offspring worry. Additionally, low mood emerged as a key symptom common to both depression and anxiety disorders (Gústavsson et al., 2021). Low mood causes children's attention shifts towards worry and to doubt themselves, including negatively evaluating their value or ability, which can result in self-criticism with the support of low mood (Gittins & Hunt, 2020). Children's emotions will become worse, and worry will increase. This flow of emotions and thoughts forms a cycle, i.e., worsening their emotional state and increasing their levels of worry. These findings collectively highlight the crucial role of emotion in the intergenerational transmission of mental health issues.

Consistent exposure to maternal negative emotions contributes to children's negative cognitive and emotional development (Augustijn, 2022). Stress, as a leading factor of depression, is associated with low mood when exposed consistently. Because of the transmissible nature of mood, a mother's negative emotion impacted by stress exposure can make children feel more stressed and meanwhile develop negative emotions (Augustijn, 2022). Hammen and colleagues (2004) examined 618 adolescents and mothers about the connections between interpersonal stress and depression. They observed that maternal depression can be transmitted to adolescents through maternal stress and adolescent stress, i.e., maternal depression generates stress, which contributes to adolescents' development of stress, and ultimately leads to adolescent depression. Another study of over 4000 mothers and children from the Avon Longitudinal Study of Parents and Children cohort (ALSPAC) explored children's daily thinking and perception at age 18 (Pearson, Fernyhough, et al., 2013). They observed that children whose parents have depressive symptoms

have a more negative thinking pattern, which places them at a higher risk of developing mood disorders (Pearson, Fernyhough, et al., 2013). This conclusion suggests that the impact of maternal mental health on children could be broad and generic on children's cognitive processing, which is a risk factor for developing mental health conditions. Similarly, Joormann et al's (2007) experiment found that girls with a depressed mother pay more attention to negative emotion faces than to positive emotion faces, compared with girls with non-depressed mothers. This study demonstrates that maternal depressive mood influences children's attentional processing of negative emotional stimuli, which places them in a vulnerable position of having low mood. Moreover, this emotional processing can last in the long term. Pelham et al. (2021) described the maternal emotional impacts on children as 'snowball' effects, which means that the negative emotional impacts received by children mix and grow in children's minds over time. Therefore, because of mothers' depressive mood, their children are more vulnerable to mood disorders, such as depression.

Maternal emotion also contributes to the development of anxiety symptoms among children. The representative symptom, excessive worry, is described as 'uncontrollable and negative-dominated anticipation of future threats (Borkovec et al., 1983). It produces a feeling of being unable to tolerate daily life uncertainties, followed by attempts to gain control through overfocus and repetitive thinking (Gústavsson et al., 2021). As most of the perceived 'worst-case scenarios' do not come true, people's thinking that their worry is useful and necessary to avoid bad outcomes is reinforced. Due to the learning behaviours that children have towards their mothers, if their mothers have overthinking or intolerance of uncertainty, children could mimic them unintentionally. Wald and colleagues (2018) conducted an experiment involving 49 mother-child dyads to anxiety disorder and 42 healthy control dyads and tested maternal cognitive appraisal towards a negative everyday stimulus, and how their children, who have observed maternal reactivities, reacted to the mother's response to the same stimulus. The results showed that mothers'

reappraisal, especially negative ones, were learned by their offspring, and this increased the risk of the child developing anxiety symptoms (Wald et al., 2018). However, this study also observed non-significant associations between maternal negative emotional reactivity, emotional responses when facing a negative stimulus, and child anxiety. A potential explanation for this is that child learning behaviour is constructed through time, and the learning cannot be built in a specific moment. In this way, this experiment cannot fully explain the potential learning of anxious behaviours and thinking. Another review article from Aktar et al. (2017) explored studies of the transmission of anxiety disorder's transmission within families, concluding that children developed anxious and emotional symptoms through observational learning and verbal interactions with their mothers. More importantly, anxious emotions do not have to meet clinical diagnostic requirements. Parental everyday life worry for a sustained period is capable of predicting their children's anxiety symptoms (Adolph et al., 2021). Combining these conclusions, maternal anxious emotions have significantly negative impacts on children's mental health, especially anxiety symptoms.

In order to account for the genetic impacts on children's emotions, adoption studies have been conducted to examine the environmental impact on children's emotions. Roos et al (2016) conducted experiments with adopted families ($N = 293$) to evaluate the association between children's mental health and adopted mothers' internalising problems. They also added birth mothers' information processing speed as an independent variable. The results suggested that when adopted mothers' internalising problems were low, children's mental health symptoms were not impacted by birth mothers' processing speed, whereas high adopted mothers' internalising problems in adopted mothers was associated with children's high internalising problems in children. Birth mothers' processing speed only became a risk factor when adopted mothers' internalising problems were high (Roos et al., 2016), which means that, in this case, the contribution of environment to transmission risk

outweighs the contribution of genetic factors from the birth mother. Another study supported this conclusion by examining the anxiety symptoms of 305 adoptive families (Ahmadzadeh et al., 2019). They observed that children's anxiety symptoms were highly correlated with adopted mothers' anxiety symptoms. They also noted a significant correlation with adopted fathers' anxiety symptoms, but the effects were weaker than maternal effects. No significant correlation was found between children and birth mothers' anxiety symptoms. These studies indicate that environmental impacts on children's emotion exist, independent of genetic effects. However, Roos et al's study was a cross-sectional study of children aged 6 or 7 years, whereas Ahmadzadeh et al's study was conducted between ages 6 and 8 years. These are very narrow ages and limit our understanding of long-term effects. More research attention is required to look at this issue from a developmental and longitudinal perspective to investigate the environmental impacts on children's emotions.

The impact of maternal emotional disturbance on adolescents' emotions persists in the short-term and long-term. Adolescence is a sensitive period for a person's cognitive development (Leussis & Andersen, 2008). A sensitive period means that negative experiences perceived during adolescence significantly impact later life cognition, brain development, and emotional regulation (Steinberg, 2005). Among these, emotion regulation is particularly crucial for children's mental health in short- and long-term. Powdthavee and Vignoles (2008) examined 4137 British families about the impact of parental mental distress on their offspring. They concluded that parental emotional impacts (especially maternal) on children can act both in the short-term, by children's reactions to their mothers' negative emotions, and in the long-term by shaping children's personality traits and making children have more similar emotional reactions in their daily life (Powdthavee & Vignoles, 2008). In the long run, negative parental emotion makes children's emotion regulation system weaker and have more negative emotions, which then results in a cognitive vulnerability for children's mental health and with higher risk of developing

depressive symptoms (Stein et al, 2014). People with a cognitive vulnerability or diathesis view the world differently than others, which makes them recall negative memories more frequently and perceive their experience more stressfully (Monroe & Simons, 1991). This is the concept of the diathesis-stress model, which explains why emotion regulation is so important for people's long-term life development and mental health. A recent test of this model on patients with depression supports this concept and suggests that people who have diathesis and experience personal life stressful events are more vulnerable to mental ill-health and could potentially experience more stressful events across time (Colodro-Conde et al., 2018). These findings demonstrate the significance of emotional regulation and its long-term impacts. Thus, both short-term and long-term negative emotional effects, which are associated with maternal emotional disturbance, produce a greater risk of mental ill-health.

It is important to note that the above findings are subject to confounding effects from other factors. First, male and female offspring could show different effects when having parents with similar mental health conditions and negative emotions. Overall, both genders have similar risk levels of developing psychological disorders if they have parents with mental ill-health (e.g., Ahmadzadeh et al., 2019; Lieb et al., 2002; Meyer et al., 2014), whereas female offspring usually experience more severe symptoms than male offspring, for example, higher levels of anger, worry, and depressive mood (Augustijn, 2022; Adolph et al., 2021; Rajyaguru et al., 2021). However, this conclusion cannot maintain that girls always suffer more from mental disorders, as some studies also report that male offspring exhibit a higher stress level than female offspring (Powdthavee and Vignoles, 2008). Either way, it can be concluded that the offspring's gender difference is associated with different symptom levels. Beyond offspring gender, parental gender sometimes plays an unignorable role. One study examined mental health transmission within 527 families mental health transmission with both parents and their children. It observed that opposite-sex parents (mother to son, father to daughter) symptoms'

transmission produce higher levels of negative effects on children's behaviours than same-sex parents (Leinonen et al., 2003). Thus, gender difference is an important confounder when studying mental health transmission, including child and parental genders.

Another important confounder is the family's Socioeconomic Status (SES). Culpin et al (2015) explored the association between early life SES adversity, i.e., lower income and less education, and the transmission of mental health by using large cohort data from the ALSPAC. They observed that adverse family SES is associated with higher levels of offspring's depressive symptoms at age 18, regardless of child gender and parents' mental health (Culpin et al., 2015). This result still has more room to be explored as one data note on the ALSPAC dataset shows that lower SES individuals are more likely to drop off from the study (Kwong, 2019). In this case, the association between SES and mental health can be underestimated as samples are biased towards higher SES participants. Another study that explored anxiety symptoms also showed that lower SES increase anxiety symptoms severity (Adolph et al., 2021). Some other studies provided similar results suggesting the negative impacts of low SES on children's mental health (e.g., Stein et al., 2014). There are two possible explanations for this outcome. First, parents with lower SES and education levels tend to care less about their child's life and use disciplinary education for child behaviours (Rajyaguru et al., 2019), and have relatively fewer social supports involved (Letourneau et al., 2019). These factors, plus economic difficulties, negatively impact parents' emotions are negatively impacted by lower SES, which will be reflected when they interact with children. Secondly, low SES could negatively impact children's self-esteem, especially during adolescence when children have more chances to connect with their peers. Many studies that examine children's self-esteem and mental health have discovered a confounding role of SES (e.g., Boden et al., 2008, Trzesniewski et al., 2006, Keane and Loades, 2017). Each of the explanations will be expanded later in this review.

Attachment's impacts on offspring's mental health.

Maternal mental health conditions not only produce negative emotions that shape children's development but also negatively impact child attachment factors. This section introduces how maladaptive parenting leads to negative parent-child relationships and produces negative mental health outcomes. Since attachment (especially family environment) is closely connected with both parents, this section does not intentionally separate maternal and paternal impacts.

Parents with mental health conditions are more likely to use maladaptive parenting styles when interacting with their children. Parents having mental health conditions have to take care of their own emotions and feelings before looking after their children, which makes them less energetic and focused on family issues, and children feel less care and acceptance from their parents (Hammen, Brennan, et al., 2004). One study of 124 families with a mentally ill parent compared with 127 families with healthy parents showed that parents with a mental illness tend to engage in less monitoring and support, less family cohesion, and eventually, more family conflict (Loon et al., 2014). Compared with children from healthy parents, higher family conflict was directly and positively associated with increased risk of children's externalising problems (Loon et al., 2014). A similar study using the National Longitudinal Survey of Children and Youth cohort data shows that parental depressive symptoms are associated with less monitoring and more rejection, which contributes significantly to children's internalising and externalising problems development (Elgar et al., 2007). Notably, however, the parental sample consisted mainly of mothers, fathers' data was significantly underrepresented. Another study (Zhou & Li, 2022) explored parental anxiety's effects on parenting engagement and children's mental health in children aged 3 to 5. They observed that maternal anxious rearing behaviours were positively related to child anxiety at both times

of the test (Zhou & Li, 2022). By contrast, paternal worry did not show significant association effects with child anxiety. Caution should be taken when interpreting these results that the duration of the study was just one year, which is not sufficient to reveal the potential long-term impacts. Despite the limitations, these studies highlight the connection between parental mental health, parenting style, and child mental health. In particular, maternal impacts are stronger compared with paternal impacts.

The impact of attachment on children's mental health is also subject to confounding effects, such as gender. A study by Elgar et al. (2007) observed that girls tend to have more internalising problems and less prosocial behaviours, and boys have more externalising problems when facing parental maltreatment. This could potentially be because different gender have different perceptions of their parents and the world around them, as girls report more parental nurturance and monitoring behaviours than boys, and boys report more parental rejection behaviours (Elgar et al., 2007). Apart from that, parents' gender also impacts child outcomes by displaying different parental rearing behaviours. Leinonen et al's (2003) report demonstrated that depressed mothers usually show less authorisation to their son, whereas depressed fathers tend to be more punitive to their son and daughter compared with parents without mental health conditions. Following these differences, girls of depressed parents are at higher risk of internalising problems, and poorer ability to manage schoolwork whereas boys tend to have a higher risk of substance use problems, poor relationships, and poorer schoolwork (Leinonen et al., 2003). In this case, child and parent gender difference makes the transmission effects different, especially during attachment interactions.

Family SES is also a confounding variable for the transmission process. Many studies have demonstrated a higher risk of developing depression because of the low SES for both adolescents and adults (Chapman et al., 2004; Kessler et al., 2010). Low SES families and parents with lower education level usually have higher stress, which leads to less time and energy of care for their

children and the possibility of family discord and, eventually, increase the risk of mental health problems (Hammen, Brennan, et al., 2004). Elgar et al (2007) also evaluated this question and noted that income inadequacy and lower educational attainment are positively associated with less parenting engagement, higher risk of child rejection, and less monitoring. Zhou and Li (2022) specifically investigated low- and middle-income background families and found prevalent child mental ill-health and poor family engagement, but the lack of a comparison group makes the results difficult to generalise.

Child self-esteem and mental health

Self-esteem is an important topic in developmental psychology and mental health, and it influences people's lives beyond childhood and adolescence. Self-esteem is the way we value ourselves, and this reflects our view of the world surrounding us. The sense of self-esteem develops from childhood but begins to enhance rapidly from adolescence, through young and middle adulthood (Orth et al., 2012). An investigation from the Longitudinal Study of Generations (LSG) dataset has observed that high self-esteem is associated with high life satisfaction, relationship quality, job satisfaction, and positive emotion, whereas low self-esteem is associated with negative emotion and depression (Orth et al., 2012). As adolescence is a sensitive period for physical and mental life development, evaluating self-esteem in this period is necessary for understanding and treating children's psychological disorders (Hosogi et al., 2012).

Low self-esteem during childhood and adolescence is strongly associated with later life mental ill-health. Keane and Loades (2017) systematically reviewed 18 community-sampled studies of childhood self-esteem and mental health. The majority of studies show large effect sizes and positive correlations between lower self-esteem and a higher risk of having 'clinically significant' mental disorders. Specifically, people who have comorbid depression and

anxiety diagnoses have the lowest self-esteem reported. Another study examined the longitudinal effects of depression by using self-esteem and self-criticism and observed that the increase of self-criticism and decrease of self-esteem is associated with higher intensity of depression symptoms, which start to increase from age 12 to 14 years (Gittins & Hunt, 2020). Boden et al (2008) also evaluated self-esteem at the age of 15 years and found that low self-esteem predicts depressive symptoms and low life satisfaction at ages 18, 21, and 25 years. However, caution should be paid in this study as most of the outcome variables' prediction effects became non-significant after controlling confounding variables, including gender, family SES, maternal education, parental alcohol usage, and adolescents' mental health issues before age 15 years. Outcome variables that remained significant after adjusting confounders are suicidal ideation and life satisfaction. It is possible that earlier mental disorders confounded this result. Although with limitations, these results supported the above conclusion about self-esteem's importance during and after childhood and adolescence, especially for psychological wellbeing. It is important to note that the temporal order of self-esteem and psychological distress is important because experiencing psychological distress at an early age does not predict later low self-esteem (Orth et al., 2008; van Tuijl et al., 2014).

Parental mental health and emotion are important factors for children's self-esteem development. A four-year longitudinal study explored Canadian adolescents' self-esteem at ages 14, 16, and 18 years and their correlations with parental mental health (Boudreault-Bouchard et al., 2013). The results show that more maternal emotional support for children aged 16 to 18 years is associated with children's high self-esteem development, whereas paternal emotional support did not show significant impacts on children's self-esteem development (Boudreault-Bouchard et al., 2013). Although their results did not find significant correlations between age 14 self-esteem and parental mental health, another study used 916 Chinese adolescents and observed that there

is a significant positive association between maternal emotional warmth and adolescents' high self-esteem at age 14 years (Peng et al., 2021). To further compensate for the age difference, Maruyama et al. (2022) used another longitudinal study to explore the connection between maternal depressive symptoms for children aged 11 and their self-esteem at age 15. The result showed a positive association between maternal depression and low self-esteem in children. Similarly, another Korean study shows that parental mental health is significantly associated with children's self-esteem between ages 10 to 12 (Lim et al., 2015). This study shows only female children's self-esteem is correlated with maternal mental health, but not male children. More caution should be taken when interpreting this result because Korean culture puts significantly influential roles on fathers and treats male children's reliance on maternal emotional support as a shame (Cervantes and Seo, 2005). In this case, the results generated cannot be generalised to other cultures that do not have this nature. Therefore, cultural differences should be generalised before conducting research on child development. Although with limitations, studies overall support the importance of parental emotion and mental status on child self-esteem development.

As with the other variables, gender is important to be considered when studying self-esteem. Previous research observed that girls tend to report lower self-esteem than boys after controlling for their age (Hosogi et al., 2012). Similar reports were made by other researchers in empirical studies (Boden et al., 2008; Isomaa et al., 2013; Maruyama et al., 2022; van Tuijl et al., 2014). The reasons behind this gender difference still require more research attention. Because adolescence is a time when children have far more interactions with other individuals beyond their family, their self-esteem can be influenced by various factors, such as beauty standards or culture pressure (Kling et al., 1999). Girls may have more sensitive feelings about the environment around them than boys, which makes them pay more attention to themselves and their perceived weaknesses. It is important to note that the gender difference in self-esteem is

not universal, some studies did not observe significant differences (e.g., Orth et al., 2008; Gittins and Hunt, 2020). Therefore, gender is an important confounder of self-esteem, but this cannot be an overarching statement that girls always report lower self-esteem than boys.

Another confounding variable is family SES. Boden et al's (2008) longitudinal study observed that adolescents who are 15 years old with low self-esteem are more likely from low SES families. Keane and Loades (2017) review also noted the associations between low self-esteem and low SES family background. Children from low SES families may have different views of themselves and the environment around them, especially during adolescence when they enlarge their opportunities of interacting with other individuals. And because of the sensitive nature of adolescent mental health development, the impact of the family background can build strong perceptions of the world around them.

Discussion and the rest of the thesis

This review focused on the intergenerational transmission of depression and anxiety primarily from mother to offspring. It introduced two paths and one risk factor of transmission. First, maternal emotion is a very impactful element for children's emotions. Mothers who have mental health conditions show more frequent negative emotions when they interact with their children; representative emotions are sadness for depression and worry for anxiety. Because of the close connections between mothers and children, children's continuous negative emotion exposure increases their risk of developing mental health conditions in the long term. Second, maternal mental illness creates a negative atmosphere for family interactions and parenting behaviours, which facilitates children's insecure attachment. In the long-term, this increases the risks of developing mental illness. Finally, maternal mental illness, plus the two paths discussed, has significant negative impacts on children's self-esteem

development. Evidence has shown that children of mothers with mental health issues have overall lower self-esteem than mothers without mental health conditions. Due to the depressive and anxious emotions and thoughts that children experience in their everyday life, they develop a more negative and pessimistic view of themselves and the world around them, which leads to low self-esteem. Following that, low self-esteem is an important predictor of mental health conditions in adulthood, including depression and anxiety.

The mechanisms behind emotional transmission vary, but one of the most influential factors is the children's learning capacity at their early age of development. Children's social learning ability allows them to observe and make sense of parental behaviours, which facilitates them to mimic their behavioural responses in similar situations (Legare, 2017). This also expands on emotional transmission. When parents regularly display similar negative emotions, especially towards one specific stimulus, children will learn this mode of cognitive processing and eventually have similar emotions when facing the same stimulus. For example, intolerance of uncertainty, a form of excessive worry towards everyday life uncertainties, is a key symptom of anxiety disorder (Rosser, 2019). Such excessive worry can be learned by children when they interact with their parents who have this symptom (Aktar et al., 2017). In this case, when facing uncertainties in life, a child who has parents with anxiety symptoms can also feel unable to tolerate and have anxious thoughts. Therefore, cognitive and behavioural learning within a family are key factors underneath the transmission mechanisms.

There are consistent studies showing the maternal mental health transmission to offspring. However, paternal mental health should be appropriately adjusted when researching maternal transmission impacts on children. Although research shows that maternal emotion and mental health exert predominant effects on children (e.g., Rajyaguru et al., 2019; Zhou & Li, 2022), this should not downplay the contribution of fathers. Research by Lieb et al (2002) conducted a 4-year longitudinal study in 2427 participants by using

diagnostic interviews to explore parental mental health transmission to children. The results stated no significant difference between maternal and paternal depression in their associations with offspring mental disorders. Other studies that used different datasets observed similar results (e.g., Powdthavee and Vignoles, 2008; Leinonen et al., 2003). Nevertheless, for studies that focused on maternal impacts on children, paternal mental health effects were sometimes unaccounted for during the measurement. For example, Wald et al. (2018) explored maternal negative emotional responses in children but did not take paternal emotional responses into consideration. Pasarelu et al. (2015) also ignored paternal worrying and anxiety when exploring maternal and child internalising symptoms, although they mentioned that it is paternal symptoms that impact child mental health development. Given the importance of paternal mental health on child development, it is possible that paternal responses have association effects with child emotion in this study, which could be a reason for the non-significant results discussed above. Thus, no matter whether the research is about parental or maternal mental effects on children, it is necessary to control paternal mental health for analysis.

The rest of the thesis consists of two research chapters, both using a longitudinal cohort study. The first chapter will explore the transmission of psychological distress by examining the associations between maternal psychological distress in early childhood age and child psychological distress, psychological wellbeing, internalising, and externalising problems in late adolescence. It will also evaluate the mediating effects of child self-esteem in early adolescence on each transmission paths. After that, chapter two will break down the term 'psychological distress' by looking at the transmissions of specific symptoms. According to the literature review, maternal psychological distress will be broken down into maternal emotional instability and maternal anxiety, while child psychological distress will consist of child depression and child anxiety. It will also add child attachment as another mediator to evaluate its mediation effects on the transmission paths. In addition, this review only

discussed two covariates, child gender and family SES. These two covariates are the most studied in previous studies but not the only two covariates. Other covariates also exist, but they were not covered as widely as these two. The two research chapters of this thesis will cover more covariates than the two discussed in this review to make the results as reliable as possible.

Research Chapter 1

Introduction

Decades of research have shown that mental health disorders, including depression, anxiety, and externalising problems pass from generation to generation (Aktar et al., 2017; Flouri et al., 2019; Gotlib et al., 2020; Kim et al., 2009; Pearson, Evans, et al., 2013; Woodruff-Borden et al., 2002). Mental health transmission is not restricted to psychological disorders but also includes psychological wellbeing. Positive mental health is not only the absence of disorders, but life with fulfilment, satisfaction, and enjoyment, which is called wellbeing (Augustijn, 2022; Schickler, 2005). Having a fulfilled and positive psychological development during adolescence, i.e., a child aged 10 years to 19 years (WHO, 2023a), is crucial for positive mental wellbeing of early adulthood and beyond. However, research about the mechanisms of mental health transmission is still at an early stage. Thus, enhanced knowledge and research on mechanisms of mental health transmission is important for understanding the insights of underlying transmission mechanisms and the strategies to mitigate the impact of these conditions across generations.

Mothers are traditionally the primary carers, which means they may have more time and opportunities to interact with children (Bianchi, 2000; Raley et al., 2012). In this case, children's feelings and mental health can be influenced by the feelings of their mother through mother-child interactions in both short- and long-term (Augustijn, 2022). In the short-term, mother-child interactions can create stress, whereas in the long-term, these interactions can accumulate negative emotions and lead to an increased risk of psychological distress, like a 'snowball' effect i.e., initial small effects develop across time and become bigger and bigger (Pelham et al., 2021; Rajyaguru et al., 2021; Zhou & Li, 2022). Thus, research on the mechanisms linking maternal psychological distress and

child psychological distress and wellbeing is crucial to understanding the intergenerational transmission of mental health.

Among the various factors that influence child and adolescent mental health, self-esteem has been identified as one of the most important factors that could directly impact a child's mental health (Hosogi et al., 2012). Broadly speaking, self-esteem refers to the feeling of self, and positive or high self-esteem means having a positive view and satisfaction of self. This sense of self originates from childhood, but rapidly develops through adolescence and extends to adulthood (Orth et al., 2012). Several studies have shown that low self-esteem during adolescence predicts later internalising (Gittins & Hunt, 2020; Keane & Loades, 2017; Orth et al., 2008) and externalising (Trzesniewski et al., 2006) problems. In terms of how maternal mental disorders influence child self-esteem, Harter's (1983) review stated that a negative parent-child relationship is associated with low child self-esteem. Hosogi et al's (2012) review also demonstrated that parental interaction with their child is crucial for a child self-esteem development. Based on these studies, it can be inferred that self-esteem can potentially mediate the transmission effects from maternal psychological distress to child mental health, but this is relatively under-studied.

Previous studies have explored the impacts of maternal mental health on child mental health across time, especially from adolescence to adulthood (Pearson, Evans, et al., 2013). Comparatively, fewer studies have examined transmission's effects within the adolescence period, i.e., how a child's mental health changes from early adolescence to late adolescence. Because of the sensitive nature and expanded social connections during adolescence (Knudsen, 2004; Leussis & Andersen, 2008), a child's mental health and wellbeing can be more easily affected and emotional changes can happen more frequently (Steinberg, 2005). Negative circumstances and emotions experienced during this time may make adolescents more vulnerable to psychological distress and have poorer mental wellbeing (Andersen, 2003). Although it is beneficial to explore how the effects impact adulthood, this could

neglect the changes in mental health status within adolescence.

The aim of this study is to explore transmission effects from maternal psychological distress in early childhood to adolescents' psychological distress, psychological wellbeing, and internalising and externalising problems in late adolescence. This is referred to as the 'direct transmission effect'. This study also explores the potential mediation role of offspring's self-esteem in early adolescence, which is referred to the indirect effects. Meanwhile, this study minimises confounding effects that could potentially bias the analysis results by controlling several covariates. Based on previous studies, I hypothesise that there are significant associations between stronger maternal psychological distress and stronger child psychological distress, internalising and externalising problems, and lower psychological wellbeing. Additionally, children's low self-esteem mediates the associations between exposure and outcome variables.

Method

Data

Data used for this chapter and this thesis was from the UK Millennium Cohort Study (MCS), a national longitudinal birth cohort study. The MCS aimed to gather multidisciplinary information throughout the participant's life to facilitate the analysis of inequality, mental health, and other comparative research with previous cohorts (Joshi & Fitzsimons, 2016). The MCS followed around 19,000 young people born in the UK from 2000 to 2001. To avoid regional bias in data collection, participants from Scotland, Wales, and North Ireland, and minority ethnic groups were oversampled. Children's male and female gender was evenly distributed, with 51% male and 49% female. In terms of child ethnicity, 82% of participants were White, 4.8% Pakistani, 2.5% Indian, and the rest of the ethnicities each had lower than 2%. Detailed information about the MCS can be found in the cohort profile (Connelly & Platt, 2014) and

<https://www.catalogumentalhealth.ac.uk/?content=study&studyid=MCS>.

To date, there have been 10 sweeps of data collection taking place, and three of them were within the Covid-19 pandemic period. The first sweep took place when children were 9 months of age. Following that, sweep 2 to sweep 7 were conducted when children were aged 3, 5, 7, 11, 14, and 17 years respectively. Data were collected through interviews with family members. Due to the complexity and large sample size of the longitudinal study, frustrations with numbers of participants were observed because of attrition, re-entry, death of participants, or emigration (Connelly & Platt, 2014). According to the record (*Centre for Longitudinal Studies*, 2023), 18818 children were recruited initially, and this number dropped to 10757 in the seventh sweep, with an attrition rate of 42.84%.

For this thesis, data was obtained from four sweeps of data collection, namely first sweep (children were aged 9 months) (University of London, 2023b), second sweep (children were aged 3 years) (University of London, 2023a), sixth sweep (children were aged 14 years) (University of London, 2023c) and seventh sweep (children were aged 17 years) (University of London, 2023d). Data was accessed through the UK Data Service, and the service portal access was provided by the University of Edinburgh. Identifiable information was removed from all datasets before I got the data. No ethics approvals were needed for the current thesis.

Measures

Maternal psychological distress

Maternal psychological distress was measured using the Malaise Inventory (MIA) at the child's age of 9 months which represents a child's early childhood. MIA is a 9-item self-report questionnaire abbreviated from the original 24-item inventory (McGee et al., 1986). Table 1.1 presents the list of questions in MIA used in this study. Each question has 2 potential answers, yes or no, and the results for the individual question are coded as 0 (do not

have the symptom) or 1 (have the symptom). For each mother, item scores were added up, with the total score ranging from 0 to 9. The higher the total score, the more severe the psychological distress. A total score of ≥ 3 is the threshold which indicates clinically significant scores (Arseneault, 2022). Confirmatory factor analyses have shown good model fit and high internal reliability (Coefficient alpha = 0.81) (McGee et al., 1986).

Table 1.1 list of MIA questions:

List of questions used

1. Do you feel tired most of the time?
 2. Do you often feel miserable or depressed?
 3. Do you often get worried about things?
 4. Do you often get into a violent rage?
 5. Do you often suddenly become scared for no good reason?
 6. Are you easily upset or irritated?
 7. Are you constantly keyed up and jittery?
 8. Does every little thing get on your nerves and wear you out?
 9. Does your heart often race like mad?
-

Offspring psychological distress

Offspring's late adolescence's psychological distress was measured at the age of 17 years by the Kessler Psychological Distress Scale (KPDS), completed by adolescents (Tomitaka & Furukawa, 2021). The KPDS is a 6-item short screening for the participants' mental health status in the past 30 days. All questions had a fixed opening "During the last 30 days, about how often did you feel ..." followed by "... So depressed that nothing could cheer you up/Hopeless/Restless or fidgety/That everything was an effort/Worthless/Nervous." Single-question scores were recoded from 1 (none of the time) to 5 (most of the time). For each adolescent, item scores were added up; total scores ranged from 6 to 30, with higher total scores indicating more severe psychological distress. Overall, the KPDS 6-item scale has been shown to have high internal reliability (Cronbach's alpha = 0.84) for both males (Cronbach's alpha = 0.83) and females (Cronbach's alpha = 0.85) (Mewton et al., 2016).

Offspring psychological wellbeing

Offspring's level of psychological wellbeing at age 17 was measured also by a self-report scale—The Short Warwick-Edinburgh Mental Wellbeing Scale (WEMWS) (Tennant et al., 2007). The scale was developed to assess the general mental wellbeing of young people and adults over the last 2 weeks. Table 1.2 lists all variables of WEMWS. Each item score ranged from 1 (none of the time) to 5 (most of the time). For each adolescent, the total wellbeing score ranges from 7 to 35, with the higher score indicating better wellbeing. The short version of WEMWS has been shown to have high reliability, with a Cronbach's alpha of 0.85 (Ng Fat et al., 2017).

Table 1.2: Short Warwick-Edinburgh Mental Wellbeing Scale questions

List of questions used

1. I've been feeling optimistic about the future
 2. I've been feeling useful
 3. I've been feeling relaxed
 4. I've been dealing with problems well
 5. I've been thinking clearly
 6. I've been feeling close to other people
 7. I've been able to make up my own mind about things
-

Offspring internalising and externalising problems.

Offspring internalising and externalising problems were measured by the Strengths and Difficulties Questionnaire (SDQ) (Vostanis, 2006). SDQ is a 25-item questionnaire used for measuring child and adolescent emotional and behavioural problems, plus prosocial behaviours. In the present study, emotion and peer problem sub-scales were used to indicate child internalising problems, whereas externalising problems were indicated by hyperactivity and conduct problem sub-scales for the last 6 months. All questions in the four subscales were presented in Table 1.3. Each question has three potential answers, from 0 (not true), 1 (somewhat true), to 2 (certainly true). Generally, questions were negatively worded, which means that higher scores indicate more severe symptoms. However, certain questions are reverse phrased such that higher scores indicate lower symptoms (e.g., I usually do as I am told). These questions were reverse coded in order to align with the measurement and analyses, ensuring that higher scores indicated more severe symptoms across all items. The SDQ has high internal reliability with Cronbach $\alpha = .73$ (Goodman, 2001).

Table 1.3 Strength and Difficulties Questionnaire questions

	List of questions used
Emotional subscale	<p>I get a lot of headaches, stomach-aches or sickness</p> <p>I worry a lot</p> <p>I am often unhappy, down-hearted or tearful</p> <p>I am nervous in new situations. I easily lose confidence</p> <p>I have many fears, I am easily scared</p>
Peer problem subscale	<p>I am usually on my own. I generally play alone or keep to myself</p> <p>I have one good friend or more</p> <p>Other people my age generally like me</p> <p>Other children or young people pick on me or bully me</p> <p>I get on better with adults than with people my own age</p>
Hyperactivity subscale	<p>I am restless, I cannot stay still for long</p> <p>I am constantly fidgeting or squirming</p> <p>I am easily distracted, I find it difficult to concentrate</p> <p>I think before I do things</p> <p>I finish the work I'm doing. My attention is good</p>
Conduct problem subscale	<p>I get very angry and often lose my temper</p> <p>I usually do as I am told</p> <p>I fight a lot. I can make other people do what I want</p> <p>I am often accused of lying or cheating</p> <p>I take things that are not mine from home, school or elsewhere</p>

Mediator: offspring's self-esteem

Offspring's self-esteem at early adolescence was measured at the age of 14 using the Rosenberg self-esteem scale, a 5-item self-report questionnaire derived of the original 10-item Rosenberg self-esteem scale (Chiu, 1988). The 5-item scale is widely used to measure the self-esteem of children and adolescents. The list of questions used was presented in Table 1.4. The questions were all positively worded. Each item has 4 potential answers, from 1 (strongly disagree) to 4 (strongly agree), and total scores range from 5 to 20. The higher the total score, the higher the level of self-esteem the children had. The Rosenberg self-esteem scale has been shown to have high internal reliability (Cronbach's alpha = 0.89) (Robins et al., 2001).

Table 1.4: Rosenberg Self-esteem Questionnaire questions

List of questions used

1. On the whole, I am satisfied with myself
 2. I feel that I have a number of good qualities
 3. I am able to do things as well as most other people
 4. I am a person of value
 5. I feel good about myself
-

Confounders

Confounders in this study include child gender (Augustijn, 2022), paternal psychological distress (Powdthavee & Vignoles, 2008), child ethnicity, maternal education (Rothenberg et al., 2022), child baseline mental health (Boden et al., 2008), maternal socioeconomic status (SES) (Culpin et al., 2015), maternal alcohol usage (Boden et al., 2008), and maternal age of giving birth (Tearne, 2015). The present study grouped confounders, according to their underlying nature, into child, maternal, and paternal factors.

Child factors include child gender, ethnicity, and baseline mental health at ages 3 and 14 years. Child baseline mental health at age 3 years was measured using the SDQ emotional subscale, completed by their parents. Child's baseline mental health at age 14 years was measured by the Short Mood and Feeling Questionnaire (SMFQ) completed by the child (Angold & Costello, 1987). The SMFQ is a self-report questionnaire designed to measure a child's mood and feeling in the past two weeks. There are 13 questions within the scale (listed in Table 1.5), each question is negatively worded (e.g., "I didn't enjoy anything at all") and has three potential answers, namely 0 (not true), 1 (sometimes), and 2 (true). For each child, item scores were summed up, with higher total scores indicating worse feelings. Previous work has shown that the SMFQ has high internal consistency shows that SMFQ has high internal reliability (Cronbach's alpha= 0.90) (Angold et al., 1987). All other child confounders were measured by one single question.

Table 1.5: Short Mood and Feeling Questionnaire questions.

List of questions used

1. I felt miserable or unhappy
 2. I didn't enjoy anything at all
 3. I felt so tired I just sat around and did nothing
 4. I was very restless
 5. I felt I was no good any more
 6. I cried a lot
 7. I found it hard to think properly or concentrate
 8. I hated myself
 9. I was a bad person
 10. I felt lonely
 11. I thought no one really loved me
 12. I thought I could never be as good as other kids
 13. I did everything wrong
-

Maternal factors include maternal education, SES, alcohol usage, and age of giving birth. Maternal SES was measured by using National Statistics Socioeconomic Classification 5 classes to assign social class according to the mother's last job (Office for National Statistics, 2023). Although the original classification uses five social classes, these were recoded into three classes in this study: management and intermediate-management level (highest), skilled employee or lower supervision (middle), and routine and semi-routine (lowest). A similar coding method was used to categorise maternal education: A-level and higher qualifications (highest), qualifications below A-level (middle), and no qualifications (lowest). All other variables were used as originally labelled. These factors were completed by mothers at sweep 1 of data collection.

Similar to maternal psychological stress, paternal psychological distress was measured by the MIA, and all methods and coding are identical to maternal psychological distress. Although the focus of the current study is maternal mental health, it by no means devalues paternal mental illness impacts. Research has identified that paternal mental ill-health increases the risk of a child developing mental health conditions, which sometimes even outweigh maternal impacts (Powdthavee & Vignoles, 2008). However, studies that examine maternal mental health effects on children usually ignore paternal mental health altogether. This study, therefore, controls the effect of paternal mental health to avoid potential biases.

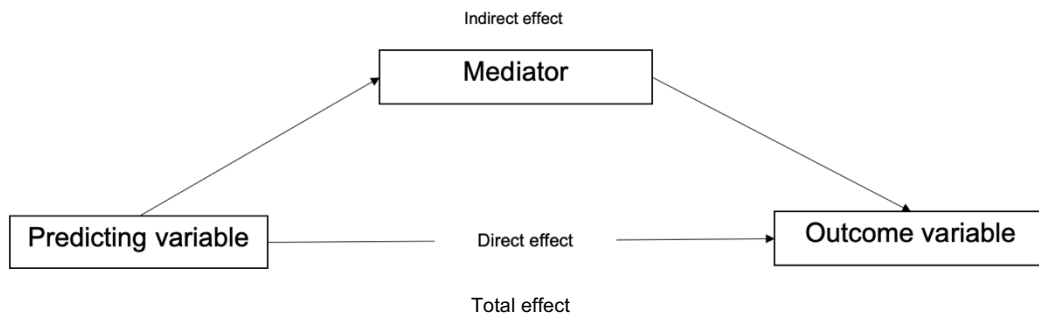
Statistical analysis

All statistics in this analysis were conducted using RStudio (version 2022.07.2+561) (RStudio team, 2022). Descriptive statistics were obtained for each variable. As maternal psychological distress is the sole independent variable in this study, all mediator and outcome variables were displayed in other descriptive statistics and grouped according to whether maternal

psychological distress is above- or below-threshold. This gives an initial comparison of the variables based on the predictor. The chi-square test demonstrates whether the data distribution is significantly different between the two groups. Prior to testing the hypotheses of mediations and impacts, correlation analysis was used to assess the association between predictor, outcome, and mediating variables. This study used list-wise deletion to check and remove any missing values before each analysis.

Once the correlation had been checked, the regression analysis was conducted to examine the independent associations of the predictor variable on the outcome variables while controlling other involved variables (i.e., confounders). Standardised betas were generated from the regression models. By using standardised betas, scaled by standard deviations, the effect sizes of each variable are able to be directly compared. Once the regression analysis was completed, mediation analysis was conducted to test the direct effect from predictor to outcome variables and the indirect mediating effect i.e., self-esteem's mediating effects between maternal psychological distress and offspring psychological distress and wellbeing. This analysis used the mediation package (Tingley et al., 2014). Figure 1.1 illustrates the basic structure of mediation analysis. This time, standardised betas were used for comparison between models. Here, four mediation models were conducted for each outcome variable, namely unadjusted, adjusted child factors, adjusted child and maternal factors, and adjusted child, maternal, and paternal factors. It is important to note that because of the importance of a child's mental health at age 14 years and its correlation with a child's self-esteem, mental health at age 14 years is included in a separate sensitivity analysis with all variables added in.

Figure 1.1: Mediation analysis pathway



Results

Descriptive statistics and correlation analysis

Descriptive statistics, including child gender, child psychological distress, wellbeing and self-esteem are provided in Table 1.6. The descriptive statistics were then split by whether mothers' psychological distress was significant or non-significant (Table 1.7). There were 4626 children of mothers with above-threshold psychological distress and 13304 children of mothers below-threshold distress. Children of mothers with below-threshold MIA scores had higher average self-esteem scores ($M = 15.62$, $SD = 2.86$) compared with the above-threshold group ($M = 15.33$, $SD = 2.95$). At the child's age of 17 years, children of mothers with above-threshold MIA score also shows higher psychological distress scores ($M = 13.90$, $SD = 5.10$) than the below-threshold group ($M = 13.10$, $SD = 4.82$). Similar patterns were observed for child internalising and externalising scores. Psychological wellbeing scores also differed by mother's distress: children of above-threshold distressed mothers had relatively lower wellbeing scores ($M = 24.06$, $SD = 4.94$) than children of below-threshold distressed mothers ($M = 24.75$, $SD = 4.71$). Chi-square analysis indicated that the differences in the distributions were significant for all three factors.

Table 1.6: Descriptive statistics for all variables ($N = 19450$)

Child Gender	Number (percentage/valid percentage)	
Male	5941 (30.54/50.10)	
Female	5918 (30.43/49.90)	
Missing	7591 (39.03)	
Total	19450 (100)	
Child psychological status	Number of missing values (percentage)	Mean (standard deviation)
Psychological distress (KPDS*) ($N = 10060$)	9390 (49.03%)	13.29 (4.93)
Psychological wellbeing (SWEMWS*) ($N = 10036$)	9414 (48.40%)	24.57 (4.80)
Self-esteem (Rosenberg self-esteem) ($N = 11141$)	8309 (42.72%)	15.57 (2.89)
SDQ* Emotion subscale ($N = 10345$)	9105 (46.81%)	2.91 (3.74)
SDQ Hyperactivity subscale ($N = 10345$)	9105 (46.81%)	3.36 (3.72)
SDQ Conduct subscale ($N = 10345$)	9105 (46.81%)	1.21 (2.99)
SDQ Peer Relation subscale ($N = 10345$)	9105 (46.81%)	1.66 (3.12)
SDQ Internalising subscale ($N = 10345$)	9105 (46.81%)	4.57 (6.73)
SDQ Externalising subscale ($N = 10345$)	9105 (46.81%)	4.56 (6.30)
Child mental health baseline at 9 month ($N = 14922$)	4528 (23.28%)	1.39 (1.52)
Child mental health baseline at age 14 ($N = 11176$)	8274 (42.54%)	5.52 (5.85)
Parental psychological status		Mean (standard deviation)
Maternal MIA* score ($N = 17992$)	1458 (7.50%)	1.70 (1.80)
Paternal MIA score ($N = 12865$)	6585 (34.10%)	1.37 (1.57)

Child ethnicity	Number (percentage/valid percentage)
White	13056 (67.13/ 83.31)
Minority	2615 (13.44/16.69)
Missing	3779 (19.43)
Maternal Alcohol Usage	Number (percentage/valid percentage)
Do not use alcohol	13328 (68.52)
2 time a month or less	3767 (19.37)
more than 1 time a week	1600 (8.23)
Missing	755 (3.88)
Maternal Socioeconomic Status	Number (percentage/valid percentage)
lower class	6847 (35.20)
middle class	1666 (8.57)
higher class	8032 (41.30)
Missing	2905 (14.94)
Maternal Education	Number (percentage/valid percentage)
No academic degree	3643 (18.73)
GCSE	8783 (45.16)
A-level or above	6256 (32.17)
Missing	768 (3.95)
Maternal age at birth	Number (percentage/valid percentage)

12 to 19	1603 (8.20)
22 to 29	8742 (44.90)
30 to 39	7999 (41.10)
40 plus	406 (2.10)
Missing	3 (0.00)

*KPDS = Kessler Psychological Distress Scale

SWEMWS = Short Warwick-Edinburgh Mental Wellbeing Scale

SDQ = Strengths and Difficulties Questionnaire

MIA = Malaise Inventory

Table 1.7: Descriptive statistics for all variables of interest based on maternal psychological distress status ($N = 19450$)

Maternal Psychological Distress			
	Significant distress (N = 4626)	Non-Significant distress (N = 13304)	Statistical test
Child Gender	Number (valid percentage/percentage)		P value (χ^2)
Male	1399 (30.24/50.91)	4103 (30.84/49.79)	
Female	1349 (29.16/49.09)	4146 (31.16/50.26)	
Missing	1878 (40.60)	5055 (40.60)	
Child Psychological Status	Mean (standard deviation)		
Psychological distress (KPDS*)	13.9 (5.1)	13.1 (4.82)	< 0.01
Psychological wellbeing (SWEMWS*)	24.06 (4.94)	24.75 (4.71)	< 0.01
Self-esteem (Rosenberg self-esteem)	15.33 (2.95)	15.62 (2.86)	< 0.01
SDQ Internalising subscale	4.9 (6.94)	4.47 (6.14)	< 0.01
SDQ Externalising subscale	4.68 (6.77)	4.52 (6.11)	< 0.01
Child mental health baseline at 9 month	1.81 (1.77)	1.21 (1.36)	< 0.01
Child mental health baseline at age 14	6.18 (6.16)	5.34 (5.75)	< 0.01
Controlled variables			
Paternal MIA score	1.78 (1.78)	1.23 (1.47)	< 0.01

Child Ethnicity	Number percentage)	(percentage/valid
White	3057 (65.87/82.96)	9417 (70.53 / 86.83)
Minority	628 (13.53/17.04)	1428 (10.70 / 13.17)
Missing	956 (20.60)	2506 (18.77)
Maternal Alcohol Usage		
Do not use alcohol	3265 (70.35)	9413 (70.50)
2 time a month or less	938 (20.21)	2783 (20.84)
more than 1 time a week	432 (9.30)	1129 (8.46)
Missing	6 (0.12)	26 (0.19)
Maternal Socioeconomic Status		
lower class	1989 (42.86)	4645 (34.79)
middle class	417 (8.99)	1214 (9.09)
higher class	1643 (35.40)	6280 (47.04)
Missing	592 (12.76)	1212 (9.08)
Maternal Education		
No academic degree	1117 (24.07)	2157 (16.16)
GCSE	2271 (48.93)	6269 (46.96)
A-level or above	1140 (26.75)	4906 (36.75)
Missing	13 (0.28)	19 (0.14)
Maternal age at birth		

12 to 19	507 (10.92)	1042 (7.80)
22 to 29	2288 (49.30)	6033 (45.19)
30 to 39	1753 (37.77)	5985 (44.83)
40 plus	93 (2.00)	289 (2.16)
Missing	0 (0.00)	2 (0.02)

*KPDS = Kessler Psychological Distress Scale

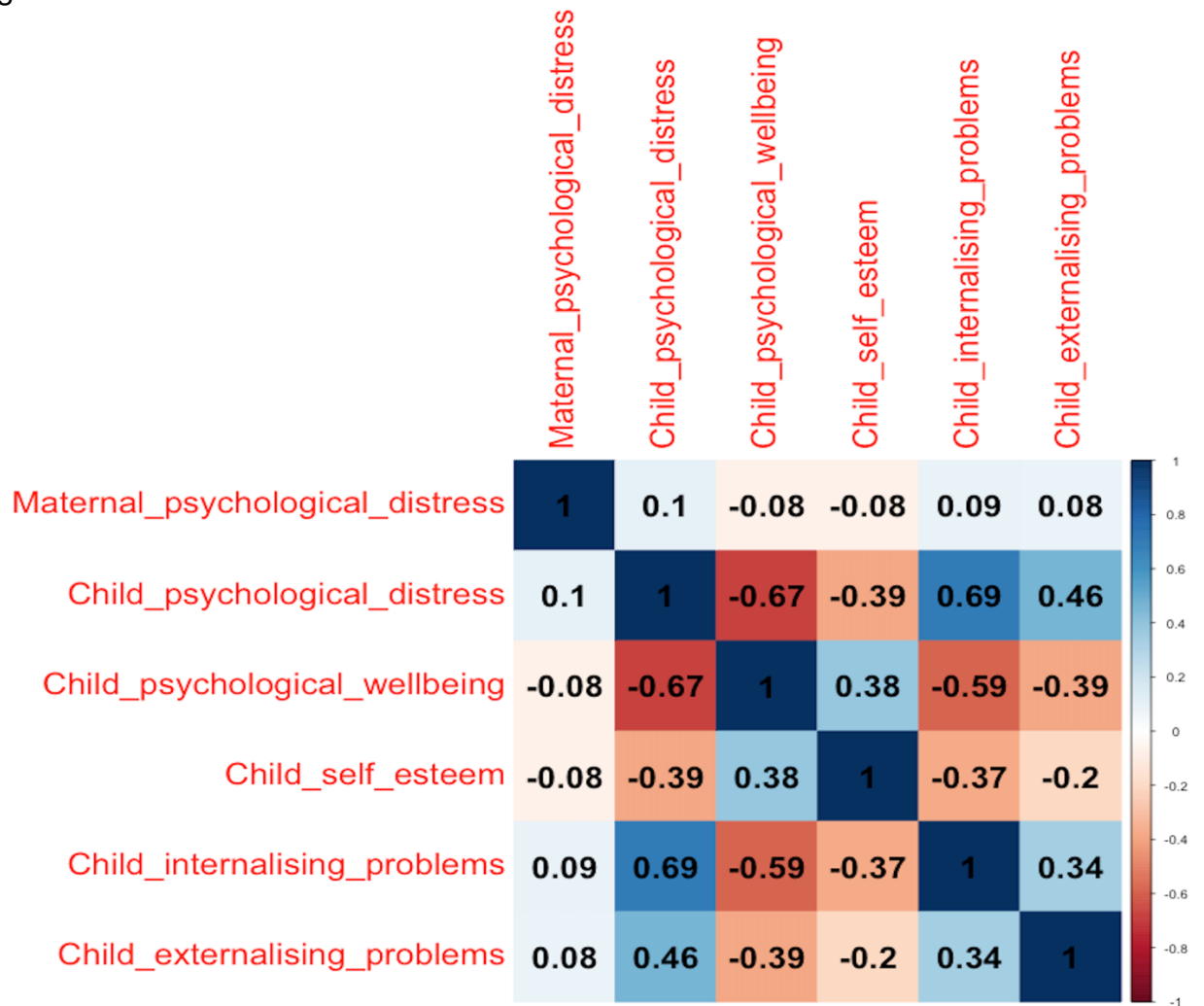
SWEMWS = Short Warwick-Edinburgh Mental Wellbeing Scale

SDQ = Strengths and Difficulties Questionnaire

MIA = Malaise Inventory

While there were significant differences between children's scores in different maternal MIA groups, the results from correlation analysis showed mother's mental health does not correlate very strongly with children's self-esteem ($r = -0.08, p < 0.01$), psychological distress ($r = 0.10, p < 0.01$), psychological wellbeing ($r = -0.08, p < 0.01$), internalising problem ($r = 0.09, p < 0.01$), and externalising problems ($r = 0.08, p < 0.01$) (Figure 1.2). The five measures of children's mental health and wellbeing showed stronger correlations, especially the negative correlation between higher children's wellbeing and children's psychological distress ($r = -0.67, p < 0.01$), and the correlations between higher internalising problems and both higher psychological distress ($r = 0.69, p < 0.01$) and lower wellbeing ($r = -0.58, p < 0.01$) (Figure 1.2). These correlations indicate that those with poorer mental health on one measure also tend to have poorer mental health on other measures.

Figure 1.2: Correlation matrix for all variables of interest*



*This figure is a heatmap of correlation analysis. Blue represents positive correlation and orange represents negative correlation. The darker the colour, the stronger the correlation coefficient.

Regression Analysis

Univariate (unadjusted model) and multivariate (adjusted models) regression analyses for children's psychological distress, wellbeing, internalising, and externalising scores were displayed in Table 1.8. In this analysis, maternal psychological distress at child aged 9 months was set as the predictor variable, and child self-esteem at child aged 14 years was the mediator. Other confounding variables were added to subsequent models to test their effects in the mediation processes. In the unadjusted model, the standardised beta coefficient from regression analysis showed that higher maternal psychological distress is directly associated with higher children's psychological distress at age 17 years ($\beta = 0.30, p < 0.01$). The association remains significant even when controlling for the confounders. The same pattern of results could be found between maternal mental health and children's internalising problems ($\beta = 0.22, p < 0.01$), and externalising problems ($\beta = 0.21, p < 0.01$). Child mental wellbeing showed a reversed pattern compared with the other three factors ($\beta = -0.24, p < 0.01$), with an association between higher maternal psychological distress and lower child mental wellbeing at age 17 years. These results remained significant after adjusting for confounding variables.

Table 1.8: Regression analysis

		Unadjusted		Adjusted ^a		Adjusted ^{ab}		Adjusted ^{abc}	
		Beta (95% CI)	P Value	Beta (95% CI)	P Value	Beta (95% CI)	P Value	Beta (95% CI)	P Value
Child Psychological distress	Maternal mental health	0.30 (0.19, 0.41)	<0.01	0.26 (0.15, 0.37)	<0.01	0.25 (0.14, 0.37)	<0.01	0.23 (0.11, 0.35)	<0.01
	Self-esteem	-1.79 (-1.90, -1.68)	<0.01	-0.61 (-0.75, -0.48)	<0.01	-0.58 (-0.71, -0.44)	<0.01	-0.57 (-0.71, -0.43)	<0.01
Child Psychological wellbeing	Maternal mental health	-0.24 (-0.35, -0.13)	<0.01	-0.22 (-0.34, -0.11)	<0.01	-0.17 (-0.29, -0.05)	<0.01	-0.16 (-0.28, -0.03)	<0.01
	Self-esteem	1.73 (1.62, 1.83)	<0.01	1.06 (0.92, 1.19)	<0.01	1.04 (0.89, 1.18)	<0.01	1.03 (0.89, 1.17)	0.01
Child internal problems	Maternal mental health	0.22 (0.14, 0.30)	<0.01	0.20 (0.11, 0.28)	<0.01	0.16 (0.07, 0.24)	<0.01	0.14 (0.05, 0.22)	<0.01
	Self-esteem	-1.25 (-1.33, -1.17)	<0.01	-0.45 (-0.55, -0.35)	<0.01	-0.42 (-0.52, -0.32)	<0.01	-4.18 (-0.52, -0.32)	<0.01
Child external problems	Maternal mental health	0.21 (0.13, 0.29)	<0.01	0.17 (0.09, 0.26)	<0.01	0.14 (0.06, 0.23)	<0.01	0.12 (0.04, 0.21)	<0.01
	Self-esteem	-0.64 (-0.72, -0.56)	<0.01	-0.30 (-0.40, -0.20)	<0.01	-0.29 (-0.39, -0.19)	<0.01	-0.29 (-0.39, -0.18)	<0.01

a: adjusted child gender, ethnicity, baseline mental health at 9 month and 14 of age.

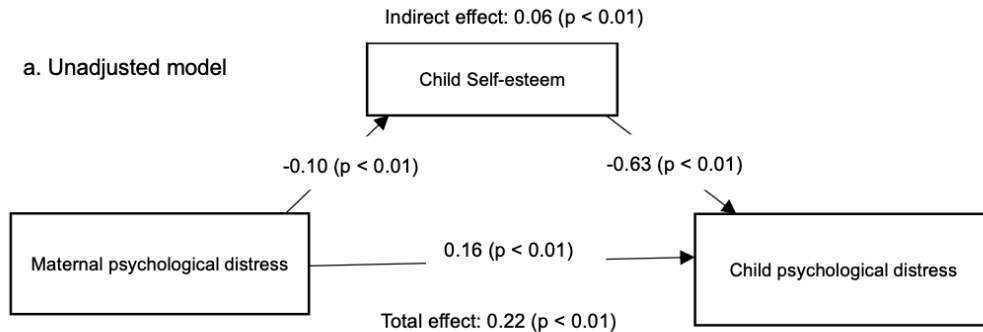
b: adjusted maternal education, age of giving birth, alcohol usage, and socioeconomic class

c: adjusted paternal mental health

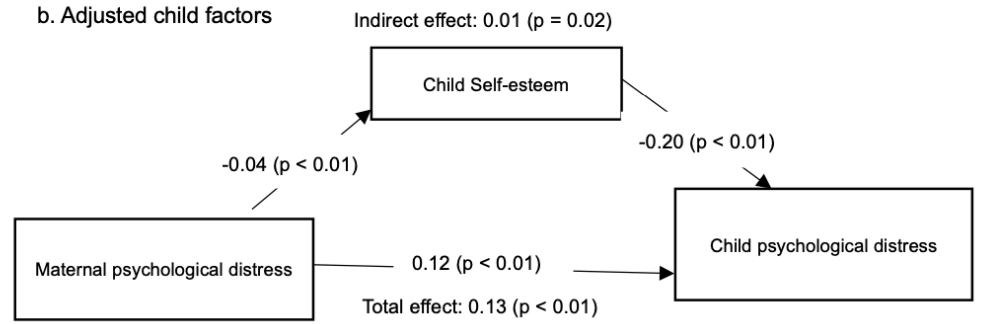
Mediation analysis

Mediation analysis was conducted to measure at what level self-esteem at age 14 years mediates the association between maternal psychological distress at the child's age of 9 months and child psychological distress, wellbeing, internalising, and externalising problems at age 17 years (Figure 1.3 to Figure 1.6). All confounders were controlled in the models again, but the child baseline mental health at age 14 years was included in the sensitivity analysis. In Figure 1.3, there was a weak association between higher maternal distress and better self-esteem ($\beta = -0.10, p < 0.01$), but a stronger association between better self-esteem and higher child distress ($\beta = 0.63, p < 0.01$). The model's indirect association ($\beta = 0.06, p < 0.01$), as mediated by self-esteem, was much less than the direct association from maternal to adolescent psychological distress ($\beta = 0.16, p < 0.01$). The effects on maternal psychological distress and adolescent psychological wellbeing were negative, with the total effect $\beta = -0.18, p < 0.01$ (Figure 1.4). Both internalising (Figure 1.5) and externalising (Figure 1.6) problems showed similar results as child psychological distress, with significant total, direct, and indirect effects, but the indirect effects were weaker than the direct effects. All the results remained significant after adjusting child, maternal, and paternal confounders.

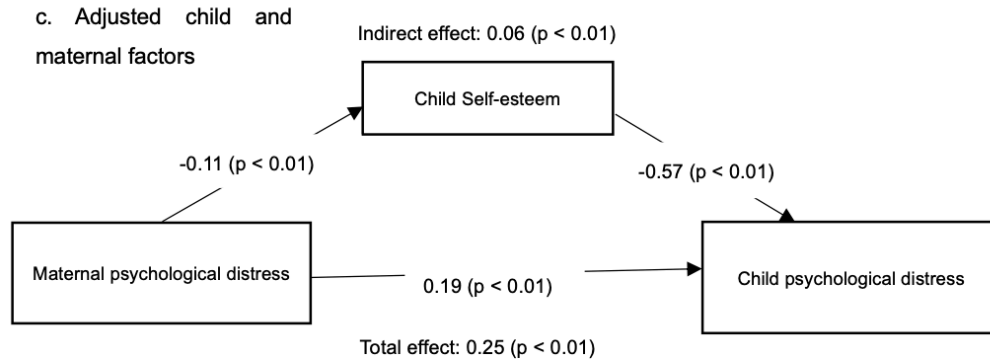
Figure 1.3: child psychological distress mediation model



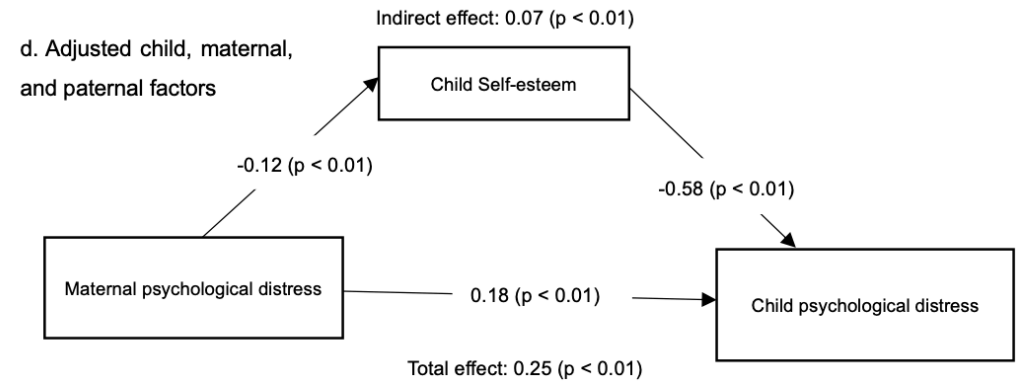
Akaike (AIC) = 90005.064 Test statistic = 1305.52 Chi-square < 0.01



Akaike (AIC) = 79974.24 Test statistic = 1966.22 Chi-square < 0.01



Akaike (AIC) = 75009.52 Test statistic = 1900.04 Chi-square < 0.01



Akaike (AIC) = 61180.81 Test statistic = 1595.33 Chi-square < 0.01

Figure 1.4: child psychological wellbeing mediation model

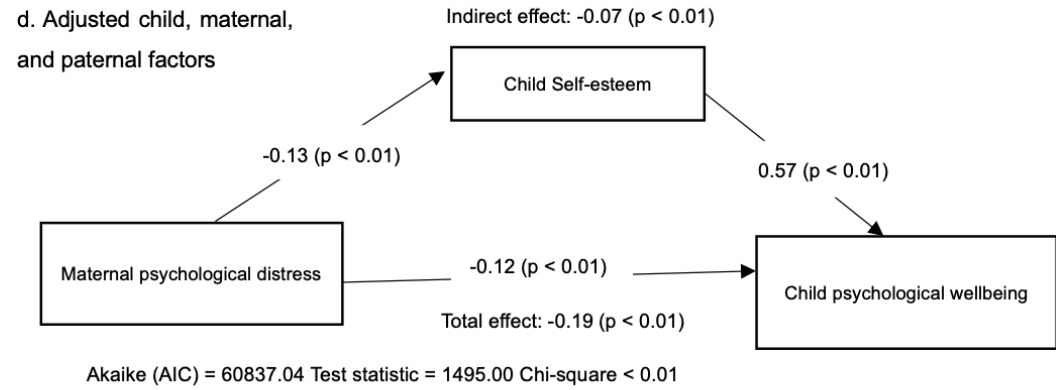
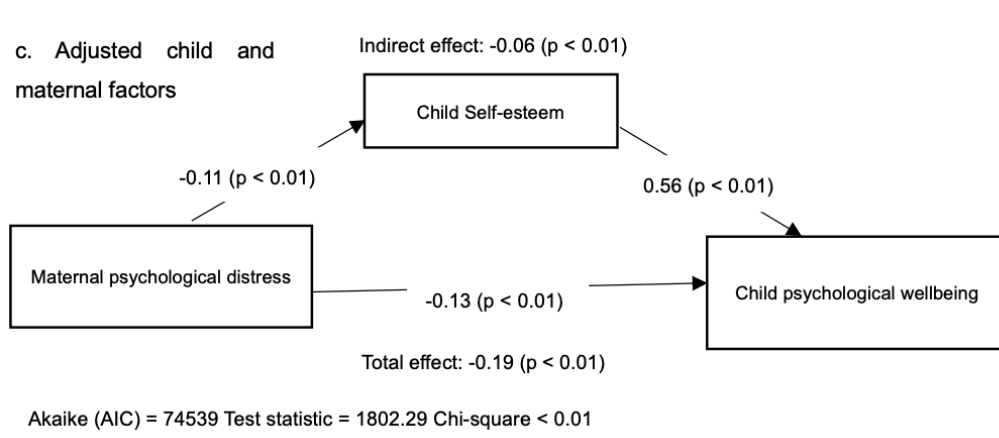
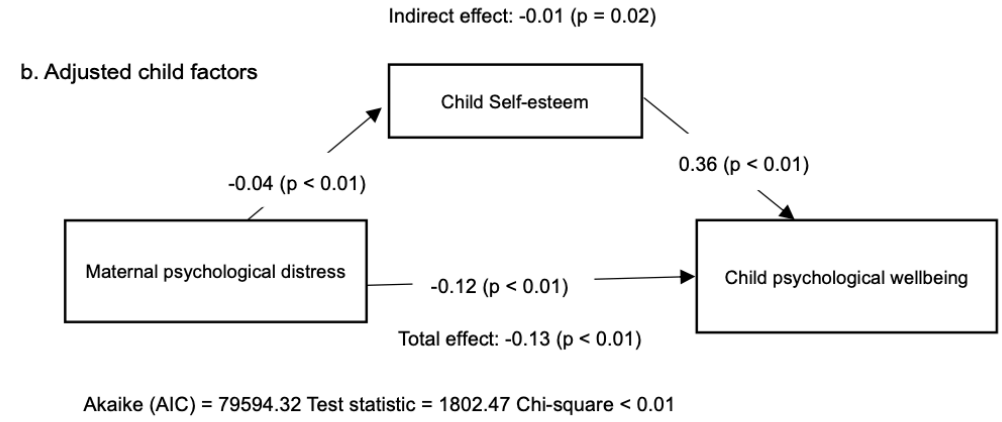
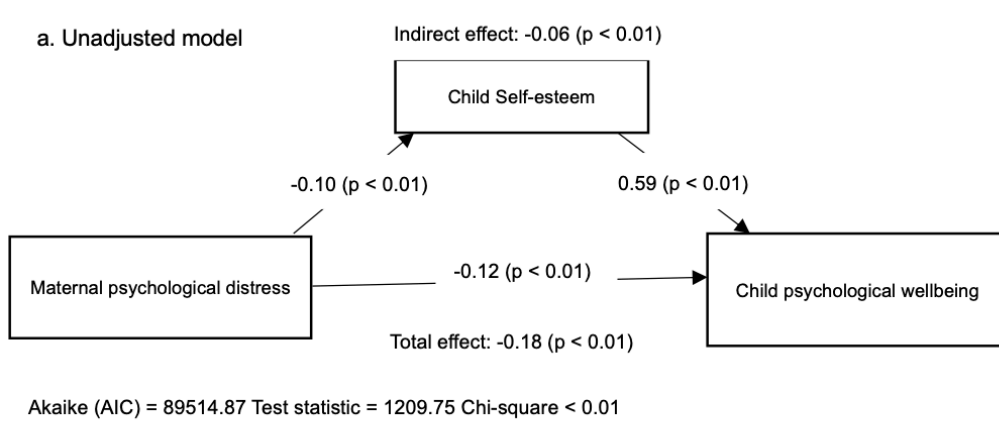


Figure 1.5: child internalising problem mediation model

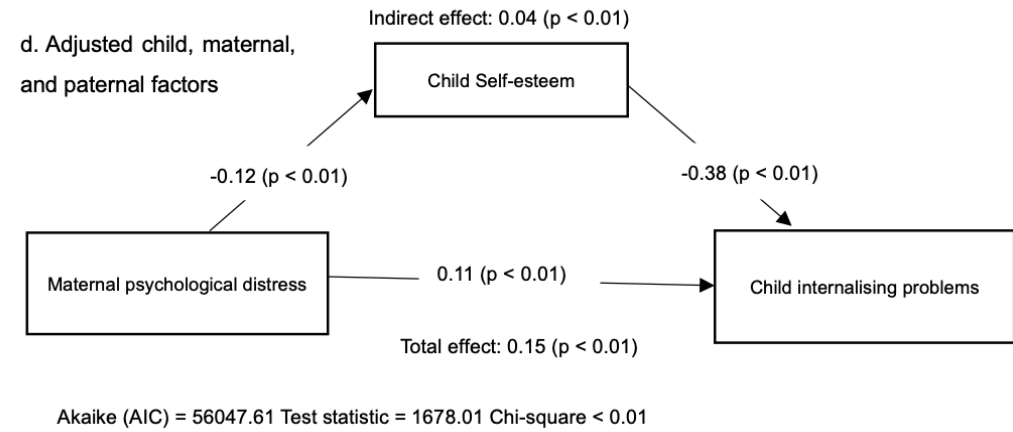
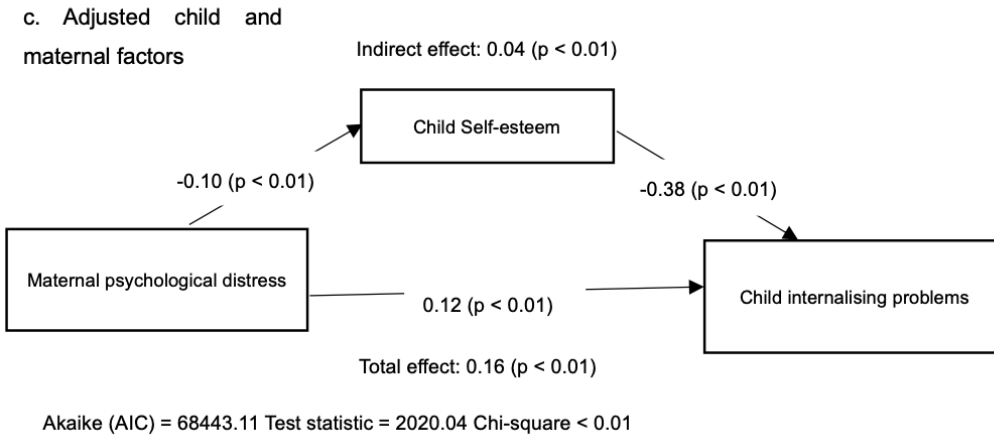
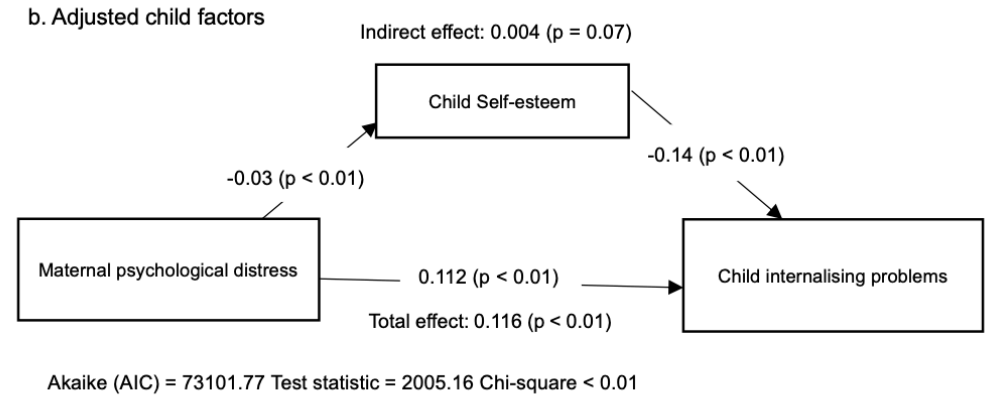
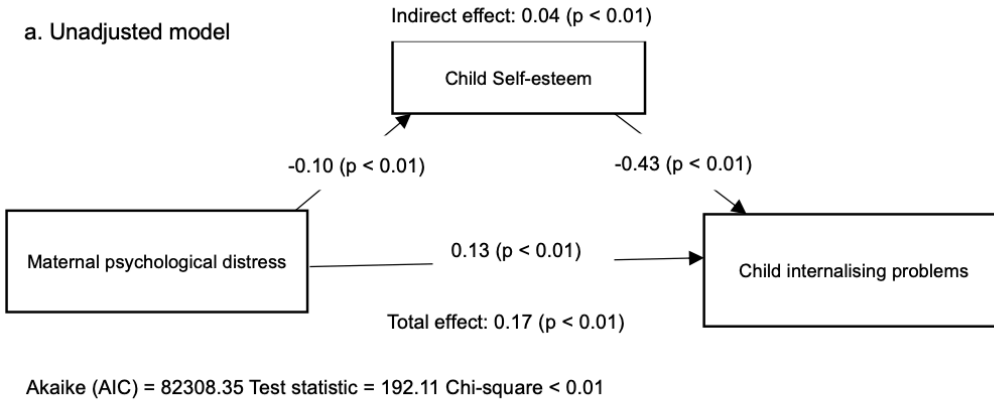
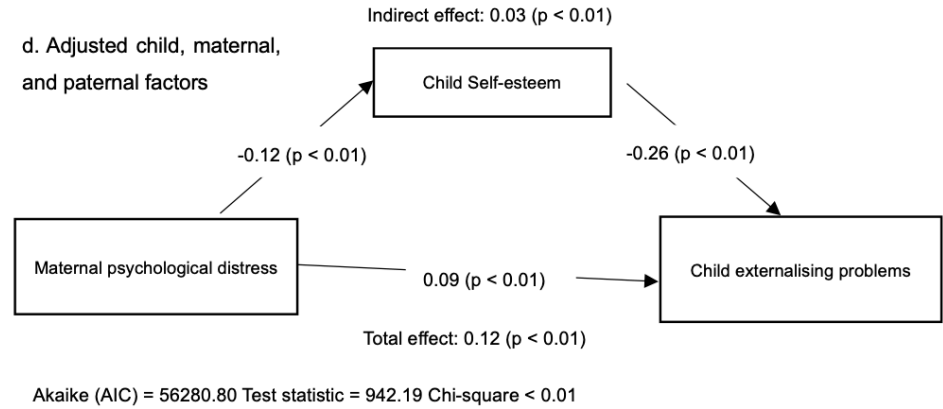
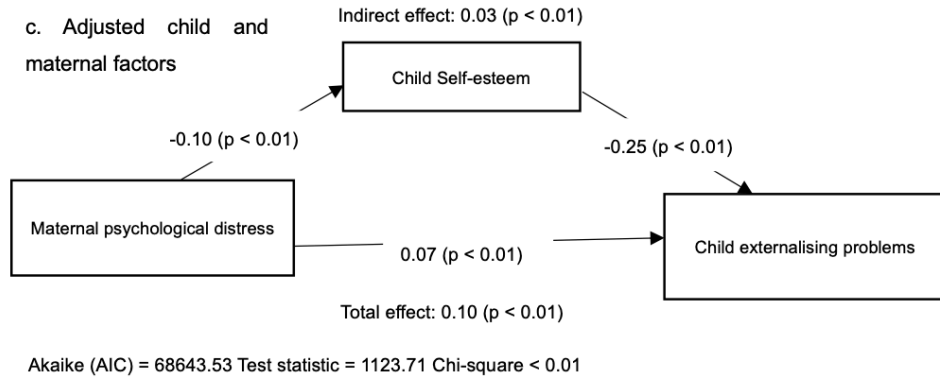
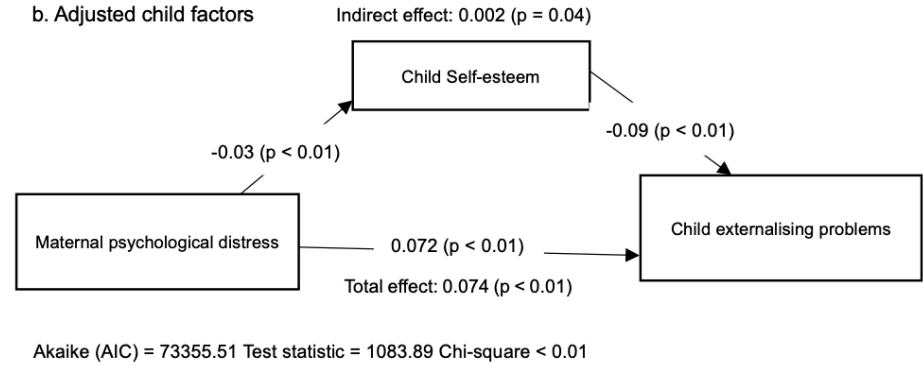
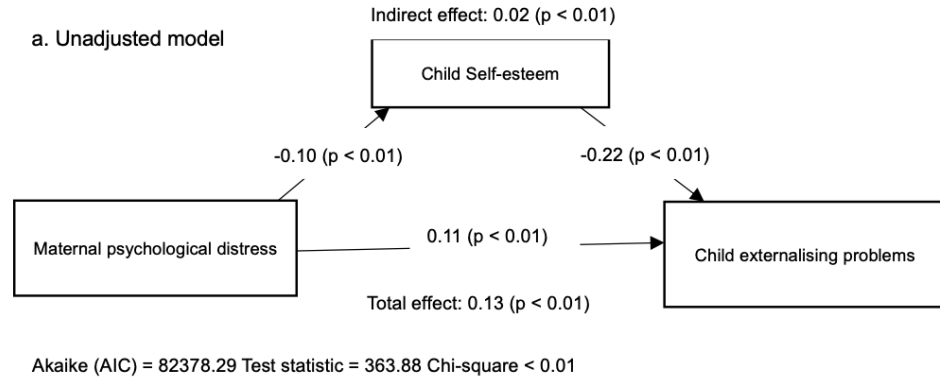


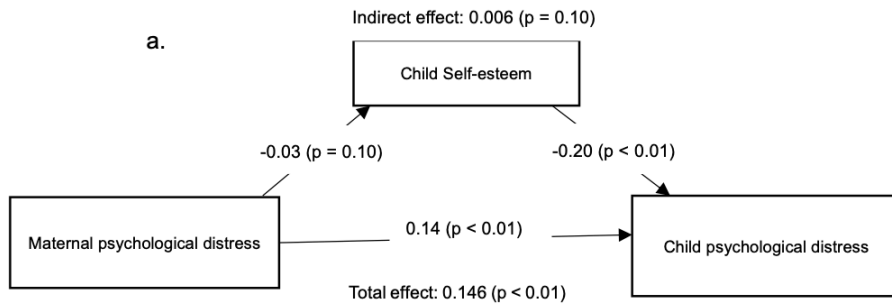
Figure 1.6: child externalising model mediation model



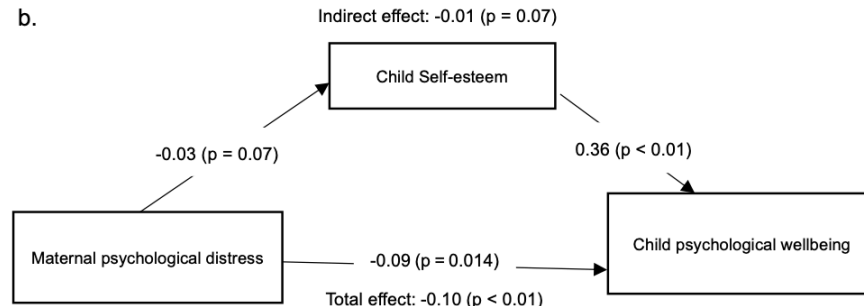
Sensitivity analysis

Given the importance of child baseline mental health at age 14 years, sensitivity analyses were conducted to measure how the models were impacted after accounting for it as a covariate (Figure 1.7). All indirect effects, i.e., the mediation effect of self-esteem, were non-significant after taking baseline mental health into consideration. The direct effects from maternal psychological distress to child outcome variables were significant throughout the sensitivity analysis, as were the total effects.

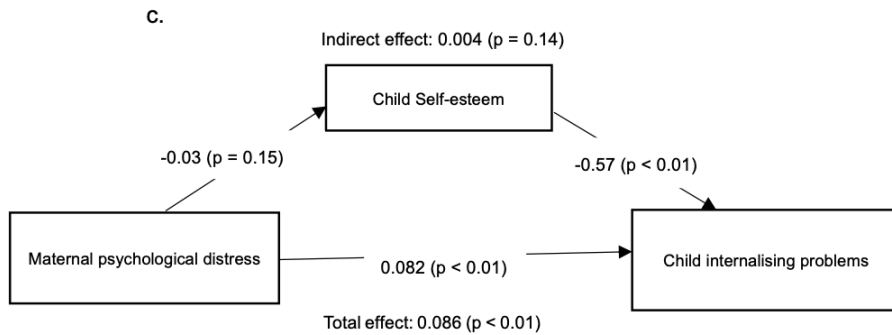
Figure 1.7: sensitivity analysis for child baseline mental health at age 14 from maternal psychological distress to child psychological distress, child psychological wellbeing, child internalising and externalising problems



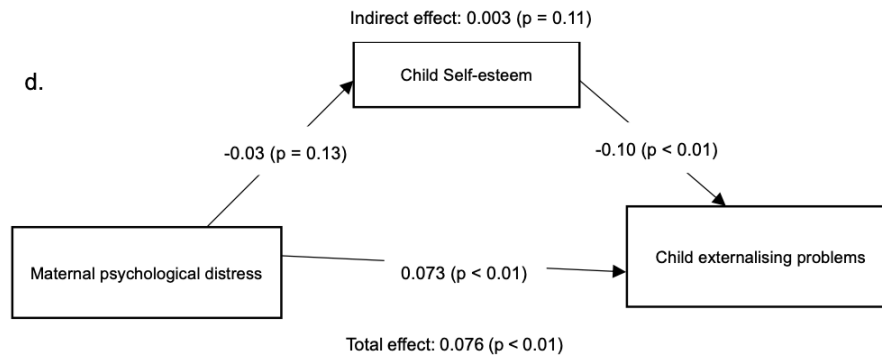
Akaike (AIC) = 57776.417 Test statistic = 4651.248 Chi-square < 0.01



Akaike (AIC) = 57892.53 Test statistic = 4085.07 Chi-square < 0.01



Akaike (AIC) = 52284.65 Test statistic = 4510.30 Chi-square < 0.01



Akaike (AIC) = 53369.81 Test statistic = 3532.27 Chi-square < 0.01

Discussion

Main findings

This study explored the transmission effects of maternal psychological distress at a child's early childhood on the child's psychological distress, psychological wellbeing, and internalising and externalising problems. It further investigated potential mediation by self-esteem at the child's early adolescence on each of the transmission paths. The results indicate positive associations between maternal psychological distress and child psychological distress, internalising and externalising problems. Previous studies using longitudinal data observed that maternal internalising behaviours were associated with an increased risk of adolescents having internalising and externalising problems (Kim et al., 2009; Letourneau et al., 2019) and depression (Hammen, Shih, et al., 2004), which are consistent with the current study's results. Maternal psychological distress was negatively associated with the child's psychological wellbeing. Although very few studies have tested condition-to-wellbeing transmission between generations, a longitudinal study's results of wellbeing-to-wellbeing transmission can be seen as consistent with the current study, which suggests that maternal emotional wellbeing has a positive association with child psychological wellbeing (Augustijn, 2022). In terms of the mediating effect of self-esteem, this research suggests that self-esteem partially mediates the effects of maternal psychological distress on all four child factors and that self-esteem significantly predicts adolescents' later mental health and wellbeing. Very few previous studies evaluated this mediation effect, but some studies have suggested that high child self-esteem is associated with good child mental health at later ages, and good maternal mental health is associated with high child self-esteem development (Boden et al., 2008; Hosogi et al., 2012; Maruyama et al., 2022).

The confounding variables adjusted in this study were divided into child,

maternal, and paternal-related variables and were added into the mediation model gradually. The child's baseline mental health at age 14 years was separately included in a sensitivity analysis. The results illustrate that both the direct effect from predictor to outcome variables and the mediating effect remain significant after adding confounders. This suggests that the direct and mediating effects tested in this study are independent of the confounding effects. Sensitivity analysis showed that all the mediating effects were non-significant when taking the child's baseline mental health at age 14 years into account, while the direct effect remained significant throughout the analyses. It is possible that the 'self-esteem' variable has contained information of mental health, and adjusting for mental health at the same age will diminish the effects of self-esteem. Thus, more efforts in future studies should be made to clearly separate the effects of self-esteem from mental health.

Strengths and limitations

There are many strengths for the current study. 1) This study used 19450 participants as the sample size, which is much more than most of the studies cited above (e.g., Augustijn, 2022; Maruyama et al., 2022). This gives the study good statistical power to detect small but meaningful associations between maternal mental health, mediators, and child mental health. 2) The longitudinal design allows tracking mental health changes over time. This provides an illustration of how mental health evolve and change across time and gives evidence of time causality. 3) This study adjusted for a variety of confounders. To the best of my knowledge, very few previous studies have taken this number of covariates into consideration. 4) Previous studies concentrating on exploring maternal mental health in transmission usually ignore the paternal mental health. This study, after controlling paternal mental health, can confidently conclude that maternal psychological distress's impact on children is independent of paternal mental health.

However, this study does not provide firm conclusions about the mediating

effects of child self-esteem within mental health intergenerational transmission. It can be seen that the mediating effect was non-significant after adjusting child 14 years' mental health. In this case, it is unclear whether self-esteem at age 14 years is a mediator or whether it is just an indicator of mental health itself. Given the significant direct effects from maternal to child mental health and the significant associations between self-esteem and child mental health, self-esteem could be another important, but relatively independent, predictor. Therefore, this study can only conclude that self-esteem partially mediates the transmission processes, and further research is required to explore the more precise role of self-esteem within the intergenerational transmission of mental health.

Additionally, this study used list-wise deletion to handle missing values. The drawback of this method is that it could delete samples that only have a small proportion of missing values, which may lead to the neglect of trends from deleted variables. It would be beneficial to replicate this study by using other methods to handle missing values to evaluate the reliability of this study's results.

Chapter conclusion

To conclude, this study explored the transmission effects of maternal psychological distress at the child's age of 9 months on the child's psychological distress, psychological wellbeing, and internalising and externalising problems at the age of 17 years. It also investigated the mediating effect of child self-esteem at age 14 years for each transmission model. The findings suggest that there are significant direct transmission effects from maternal psychological distress to the child mental health and wellbeing. It also suggests that child self-esteem is a significant mediator for each model, but the mediating effects become non-significant when taking the child baseline mental health at age 14 years into consideration.

This study leaves space for further study. First, self-esteem may not be the

only mediator for the transmission processes. Maruyama et al. (2022) explored child maltreatment as another mediator of intergenerational transmission of mental health and observed positive associations between maternal mental health conditions and emotional distress. Second, some variables in this study are very general terms, e.g., psychological distress. Using single indicators (and total scores) doesn't account for measurement error. In addition, general terms are not specific enough to tell what exact mental health conditions were measured e.g., depression or anxiety. Based on these, the next chapter will expand on this study by looking at more specific mental health conditions (depression, anxiety) and adding another mediator (attachment). It will also take care of the limitation of dealing with missing data in this chapter by using Full Information Maximum Likelihood (FIML).

Research Chapter 2

Introduction

The research chapter 1 has observed that maternal psychological distress at the child's early childhood is associated with the child's self-esteem at early adolescence, child psychological distress, psychological wellbeing, internalising and externalising problems at the child's late adolescence. Specifically, child's self-esteem partially mediates the associations between maternal psychological distress and child mental health. However, the term 'psychological distress' is overarching. Any existing mental health conditions listed on the diagnostic criteria can produce psychological distress (e.g., DSM) (American Psychological Associations, 2013). In addition, the literature review discussed that there is another important factor that influences the transmission paths from maternal to child mental health: attachment, which was not measured in chapter 1. The literature review also discussed the importance of maternal emotion's impact on children's mental health, especially depression and anxiety. Thus, this chapter will expand on chapter 1 by looking at how maternal emotional instability and anxiety at the child's early childhood are associated with child depression and anxiety at late adolescence, and how child self-esteem and attachment at early adolescence influence the associations.

One way in which poor mental health may be transmitted is through the impact of negative emotions from parents. Frequent interactions within the family make one person's negative emotions easily affect other family members. For example, the representative symptom of depression is continuous low mood, whereas for anxiety disorder it is excessive and uncontrollable worry (American Psychological Association, 2013). Continuous exposure to parental negative emotions or emotional instability can lead to offspring's emotional disturbance and can facilitate the development of mental disorders, including

depressive and anxious symptoms (Hammen, Shih, et al., 2004; Zhou & Li, 2022). Specifically, parental negative affect can induce negative effects on their children both in the short-term and in the long-term (Aktar et al., 2017; Augustijn, 2022). Thus, examining the effect of parental negative emotion is crucial for understanding the intergenerational transmission of mental ill-health.

Apart from emotion, attachment is another important factor that influences a child's mental health. As stated in the literature review, the definition of attachment includes the overall parent-child relationship and harsh parenting behaviours. Parents living with mental ill-health usually engage less with childcare and feel less energetic when interacting with their children since they need extra energy to manage their own mental health (Hammen, Brennan, et al., 2004; Loon et al., 2014). More seriously, mentally ill parents are more likely to use harsh parenting behaviours, such as smacking or shouting at their children (Kuckertz et al., 2018; Plant et al., 2015). Such behaviours can increase children's negative affect and lead to an increased risk of internalising problems (Rajyaguru et al., 2019; Speyer et al., 2022) and also negatively influence the family relationship. In this case, it is important to study the role of attachment in mental health transmission as it provides valuable information on the actual exposure to parental distress.

The present chapter aims to explore how maternal emotional instability and anxiety in early childhood predict child anxiety and depressive symptoms in late adolescence. Moreover, it examines the potential mediating effects of child self-esteem and attachment in early adolescence for each transmission path (e.g., maternal emotional stability's impact on child depression). Based on previous studies, I hypothesise that there are significant positive associations between maternal mental health symptoms and child mental health symptoms. In addition, children's low self-esteem and poor attachment styles mediate the associations between exposure and outcome variables. The covariates controlled for in this chapter are to the same as those controlled in chapter 1.

Methods

Data and measures

This longitudinal study uses data from the Millennium Cohort Study (MCS). The rest of this section only describes the measures used in this specific analysis and how the latent variables were constructed. Detailed information about the longitudinal cohort, measures, and variables' coding has been provided in chapter 1.

Maternal anxiety and emotional stability

Variables were extracted from the Malaise Inventory (MIA) measured at the child's age of 9 months. Items related to anxiety and emotional stability were taken out. Maternal anxiety variables include: "Often worried about things", "Suddenly scared for no good reason", "Constantly keyed up or jittery", and "Every little thing gets on nerves". Three variables measured maternal emotional instability, with one variable measuring depression symptom ("Often miserable or depressed"), one measuring frustrating emotion ("Often gets in violent rage"), and the final one combining the two ("Easily upset or irritated").

- Offspring anxiety

Offspring anxiety variables were extracted from the Strengths and Difficulties Questionnaire (SDQ) at the child's age of 17 years. Three variables from the emotional sub-scale were selected to target child anxiety, including "I worry a lot", "I am nervous in new situations", and "I have many fears".

Offspring depression

Child depression was measured by the Kessler Psychological Distress Scale (KPDS) at the child's age of 17 years. All 6 variables were selected.

- Offspring self-esteem

Child self-esteem was measured by a 5-item Rosenberg self-esteem scale at the child's age of 14 years. All five variables were selected.

Attachment

Attachment measures how close are children to their parents and the qualities of family interactions. Four questions were included, with one for children's closeness with mothers, labelled as "How close is CM (cohort member, refers to the child) with mother". This question was coded from one to four, with higher score means lower closeness with mother. The other three questions are binary questions about parenting behaviours, including "Tell you off or shout at you", "Ground you, stop you going out or from seeing your friends", and "Punish you in some other way". Each question has yes or no answers, yes is coded as 1 and no is 0. Combined with the question contents, a higher score indicates more harsh parenting.

- Confounders

All confounders controlled in this chapter, including variables, grouping, and coding are as described in chapter 1.

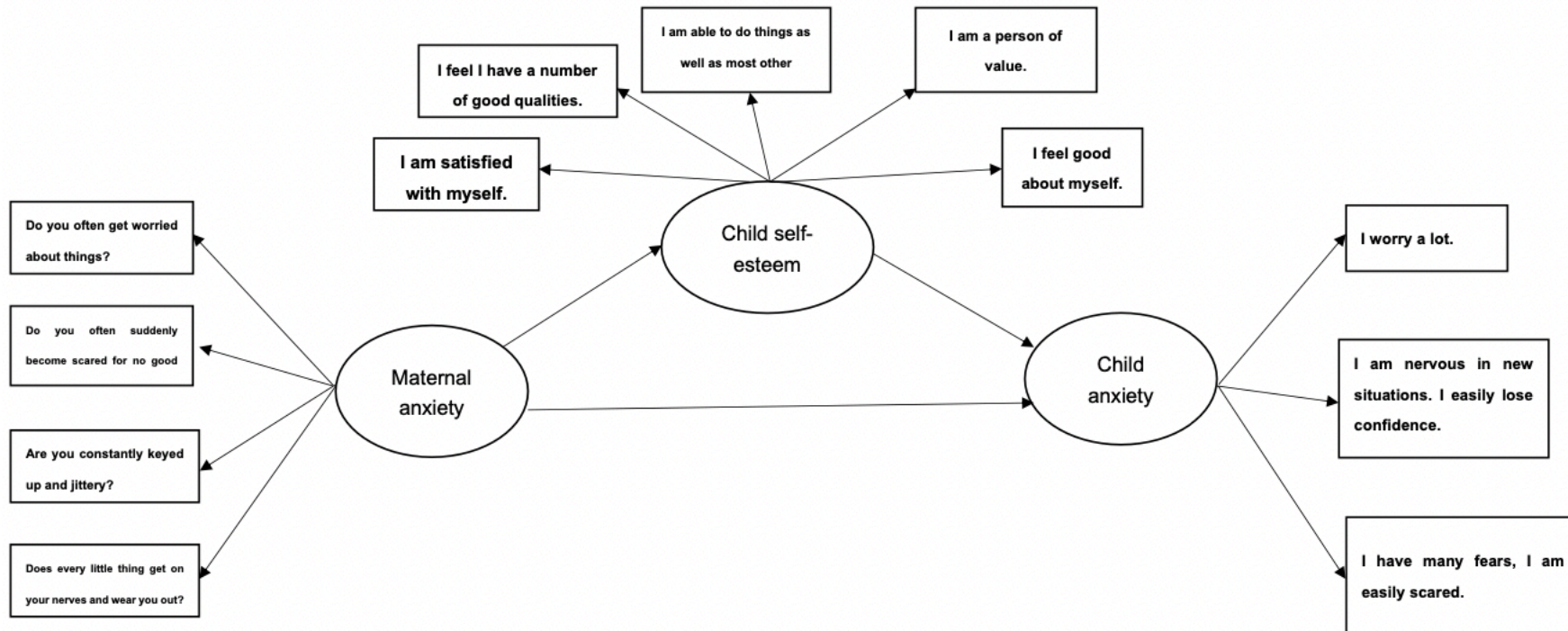
Statistical analysis

All statistical analyses were carried out using RStudio version 2022.07.2 (RStudio Team, 2022). The Structural Equation Model tool in the Lavaan package (Rosseel, 2012) was used for evaluating observed variable loadings, model fits, and conducting mediation analyses. All main variables, including exogenous variables (maternal anxiety and emotional stability), endogenous variables (offspring depression and offspring anxiety), and mediators (child self-esteem and attachment) were created as latent variables, and the indicators that made the latent variables have been described above. Latent variables are those that can only be inferred from existing observed variables through

mathematical methods. The analysis first examined the loading of observed variables onto their corresponding latent variables, which quantifies how much each observed variable is associated with the latent variable. After that, each model's fit was examined by four indicators, including Model chi-square, Comparative Fit Index (CFI), Tucker Lewis Index (TLI), and root mean square error of approximation (RMSEA).

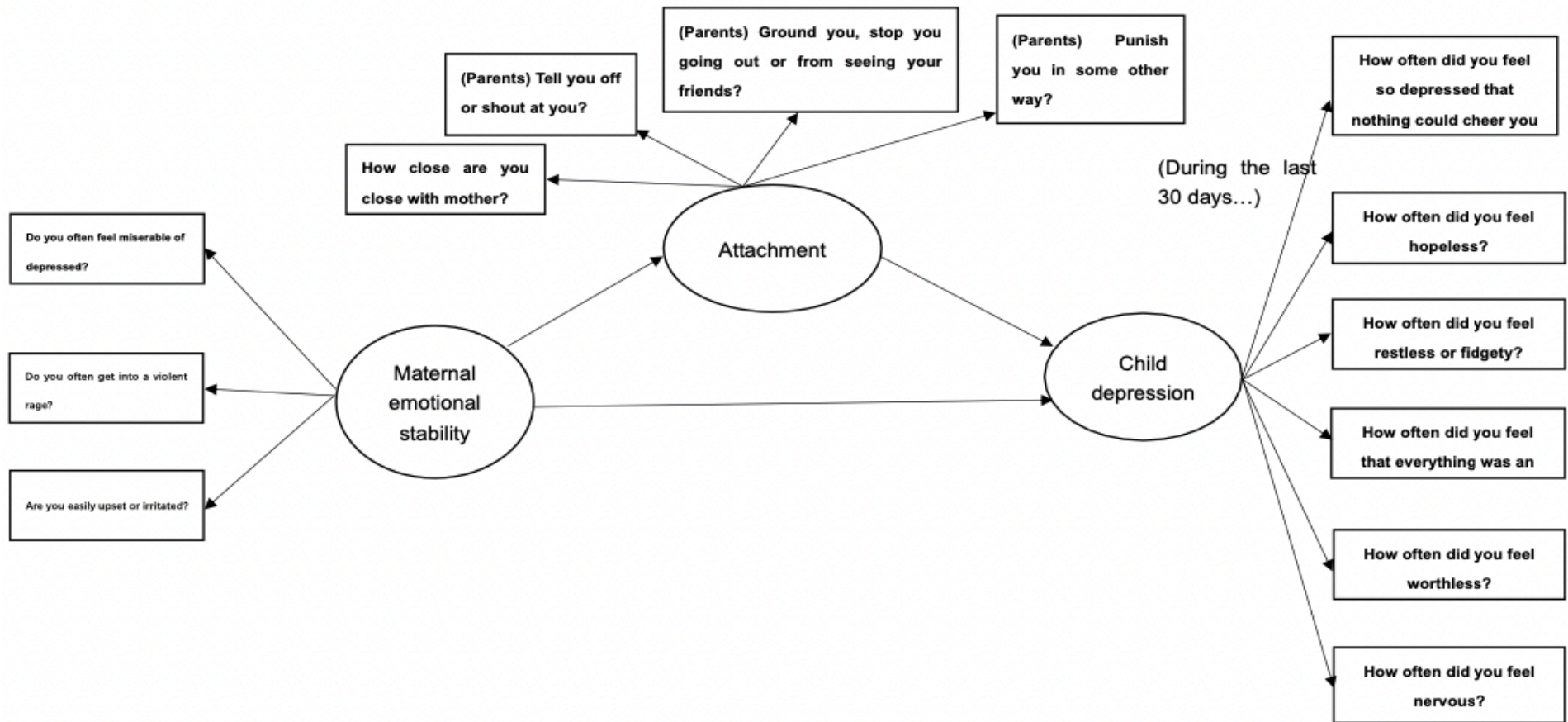
This study aims to examine each exposure variable's direct association with each outcome variable and the indirect effects that go through each mediator. Figure 2.1 and Figure 2.2 demonstrate all the latent variables, their indicators, and examples of model forms. For each exposure-outcome pair (maternal emotional instability—child depression; maternal emotional instability—child anxiety; maternal anxiety—child depression; maternal anxiety—child anxiety), I created 8 models, with 4 models for each mediator. The first model focussed on the unadjusted paths between the factors, the second model included observed confounders from childhood, the third model included observed confounders from child and mother, and the last model included child, maternal, and paternal confounders. After these, the 4 models for each pair were run again with another mediator. This measure shows the incremental impacts of adding confounders. Similar to chapter 1, sensitivity analyses were conducted for every pair with each mediator to add the child baseline mental health at age 14 years on top of all other confounders. This is to evaluate the change in associations before and after adding the child baseline mental health into the models.

Figure 2.1: latent variables and the mediation path*



*Figure 2.1 illustrates one exposure, one mediator, and one outcome latent variables and their observed indicators. This is an example of the model evaluating maternal anxiety’s association with child anxiety, and how the effect is mediated by child self-esteem. Figure 2.2 introduces another three variables and constructs.

Figure 2.2: latent variables and the mediation path continued



This study included sample weights from the MCS team. Missing values were estimated using Full Information Maximum Likelihood, which assumes that values were missing at random. The basic principle is that it estimates the likelihood function for each individual based on the variables they have available. The model fit is then derived by summing across the functions, ensuring that the model fit is based on all individuals. This measure reduces potential bias because of not taking the missing data into the analysis.

Results

Descriptive statistics

Descriptive statistics for all observed variables were provided in Table 2.1. In total, 19450 participants took part initially (chapter 1 method section has more information on this). However, because of attrition, each variable in this study has a different amount of missing data. The table covers all variables involved in this study, including exposure, mediator, outcome, and confounding variables.

Table 2.1: Descriptive statistics for all variables (N = 19450)

	N	Percentage of missing value	Mean	SD
Maternal anxiety				
Often worried about things (mother)	18095	7.07%	0.48	0.50
Suddenly scared for no good reason (mother)	18099	7.05%	0.10	0.31
Constantly keyed up or jittery (mother)	18047	7.28%	0.07	0.25
Every little thing gets on nerves (mother)	18082	7.10%	0.07	0.25
Maternal emotional stability				
Often miserable or depressed (mother)	18091	7.05%	0.15	0.36
Often gets in violent rage (mother)	18098	7.02%	0.02	0.15
Easily upset or irritated (mother)	18082	7.10%	0.24	0.43
Child attachment				
How close is child with mother	11204	42.37%	1.77	0.80
(Parents) Tell you off or shout at you?	11203	42.37%	0.92	0.27
(Parents) Ground you, stop you going out or from seeing your friends?	11080	43.00%	0.42	0.49
(Parents) Punish you in some way?	10950	43.72%	0.30	0.46
Child anxiety				
I have many fears, I am easily scared (child)	9825	49.50%	0.48	0.66
I worry a lot (child)	9835	49.45%	1.05	0.77
I am nervous in new situations. I easily lose confidence	9810	49.55%	1.04	0.76
Child depression				
During the last 30 days, about how often did you feel so depressed that nothing could cheer you up? (child)	10082	48.17%	2.05	1.04
During the last 30 days, about how often did you feel hopeless? (child)	10087	48.14%	1.89	1.02
During the last 30 days, about how often did you feel restless or fidgety? (child)	10096	48.10%	2.42	1.1
During the last 30 days, about how often did you feel that everything was an effort? (child)	10085	48.15%	2.61	1.69
During the last 30 days, about how often did you feel worthless? (child)	10087	48.14%	1.83	1.11
During the last 30 days, about how often did you feel nervous? (child)	10090	48.13%	2.47	1.04
Child self-esteem				
On the whole, I am satisfied with myself	11258	42.07%	3.09	0.69
I feel I have a number of good qualities	11270	42.01%	3.14	0.66
I am able to do things as well as most other people	11273	42.00%	3.17	0.65
I am a person of value	11176	42.46%	3.11	0.65
I feel good about myself	11257	42.10%	3.05	0.74
Child Gender				
	18785	3.42%	1.50	0.50
Child baseline mental health at age 3				
	14922	23.24%	1.39	1.52
Child baseline mental health at age 14				
	11176	42.46%	18.52	5.85
Paternal anxiety				
Often worried about things (partner)	12901	33.73%	0.42	0.49
Suddenly scared for no good reason (partner)	12899	33.74%	0.05	0.22
Constantly keyed up or jittery (partner)	12881	33.83%	0.06	0.24
Every little thing gets on nerves (partner)	12899	33.74%	0.05	0.22
Paternal depression				
Often miserable or depressed (partner)	12898	33.75%	0.11	0.32
Often gets in violent rage (partner)	12899	33.74%	0.03	0.18
Easily upset or irritated (partner)	12899	33.74%	0.18	0.38
Maternal alcohol usage				
	18695	3.90%	0.37	0.64
Maternal age of giving birth				
	18750	3.69%	28.36	5.97
Maternal education				
		Frequency	Percentage	
	No qualification	3643	18.73%	
	GCSE	8783	45.16%	
	A-level or higher	6256	32.17%	
	Missing	768	3.94%	
	Total	19450	100%	
Maternal Socioeconomic status				
	Lower class	6847	35.20%	
	Middle class	1666	8.57%	
	Higher class	8023	41.30%	
	Missing	2905	14.94%	
	Total	19450	100%	
Child ethnicity				
	White	13056	67.13%	
	Other	2615	13.44%	
	Missing	3779	19.43%	
	Total	19450	100%	

Observed variables loading.

The loading of observed variables onto their corresponding latent variables was first examined. Variable loadings are presented in Figure 2.3 and Figure 2.4. All observed variables were loaded into the latent variables in the expected direction: positive loadings. For the two latent variables that used all variables of the scale (child depression and child self-esteem), the observed variable loadings were the strongest, with most values bigger than 0.80. Following that, the three observed variables for child anxiety also showed moderately strong, all variables with loading above 0.60. Most of the observed variable loadings for the two maternal exogenous variables were moderate, which range between 0.40 to 0.60. The observed variable 'Do you often feel miserable or depressed?' has a moderately strong loading of 0.65, and 'Do you often get into violent rage' has a moderately weak loading of 0.27. The observed variables of child attachment had weak loadings, with only 'How close are you close with mother?' having a moderate loading of 0.44. The variable '(parent) tell you off or shout at you' had a very weak loading (0.04) and was non-significant ($p = 0.14$). Despite the non-significant loading, this variable was conceptually central to the 'attachment' latent variable and was not removed from the model.

Figure 2.3: Variable loading*

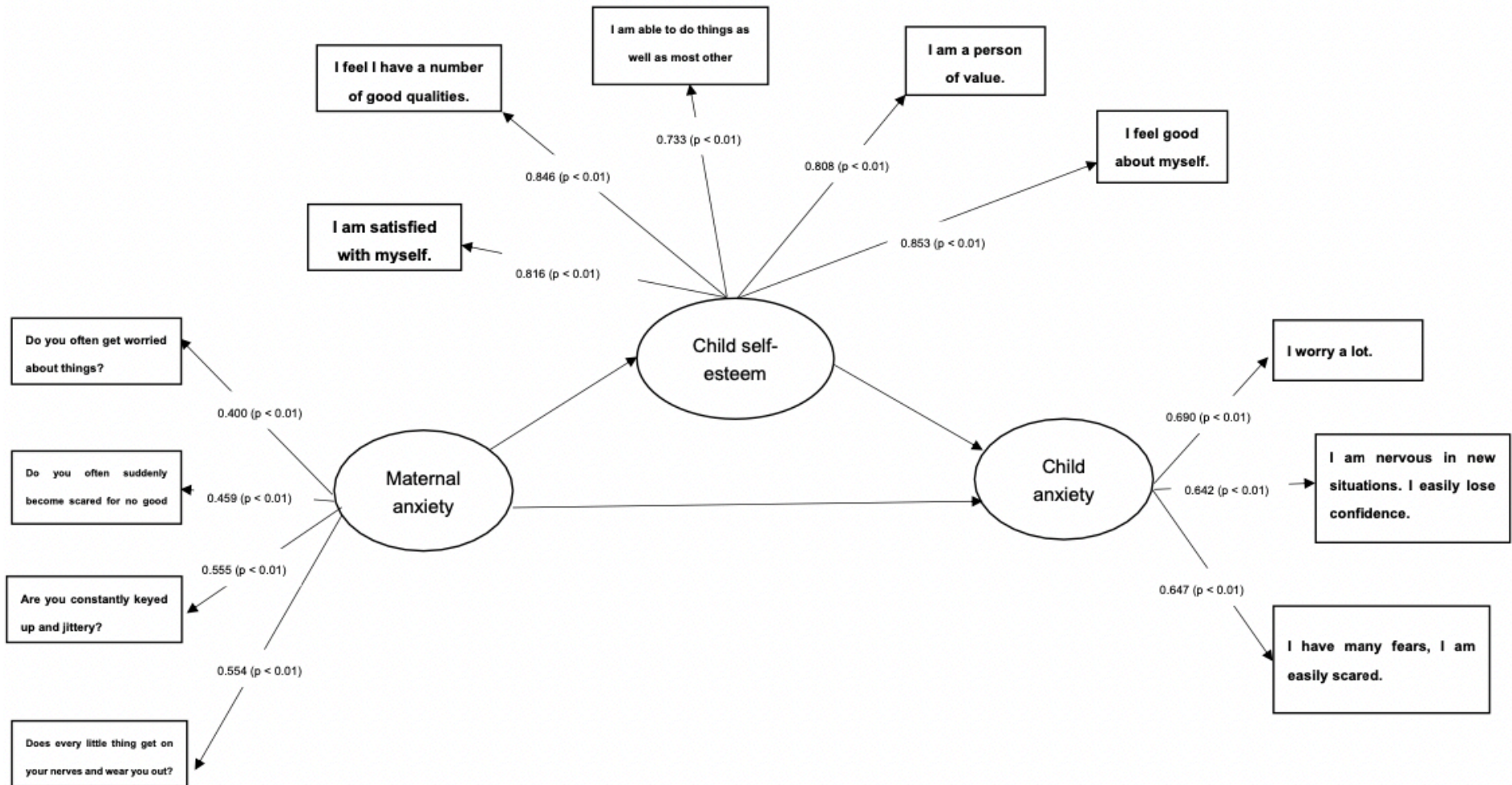
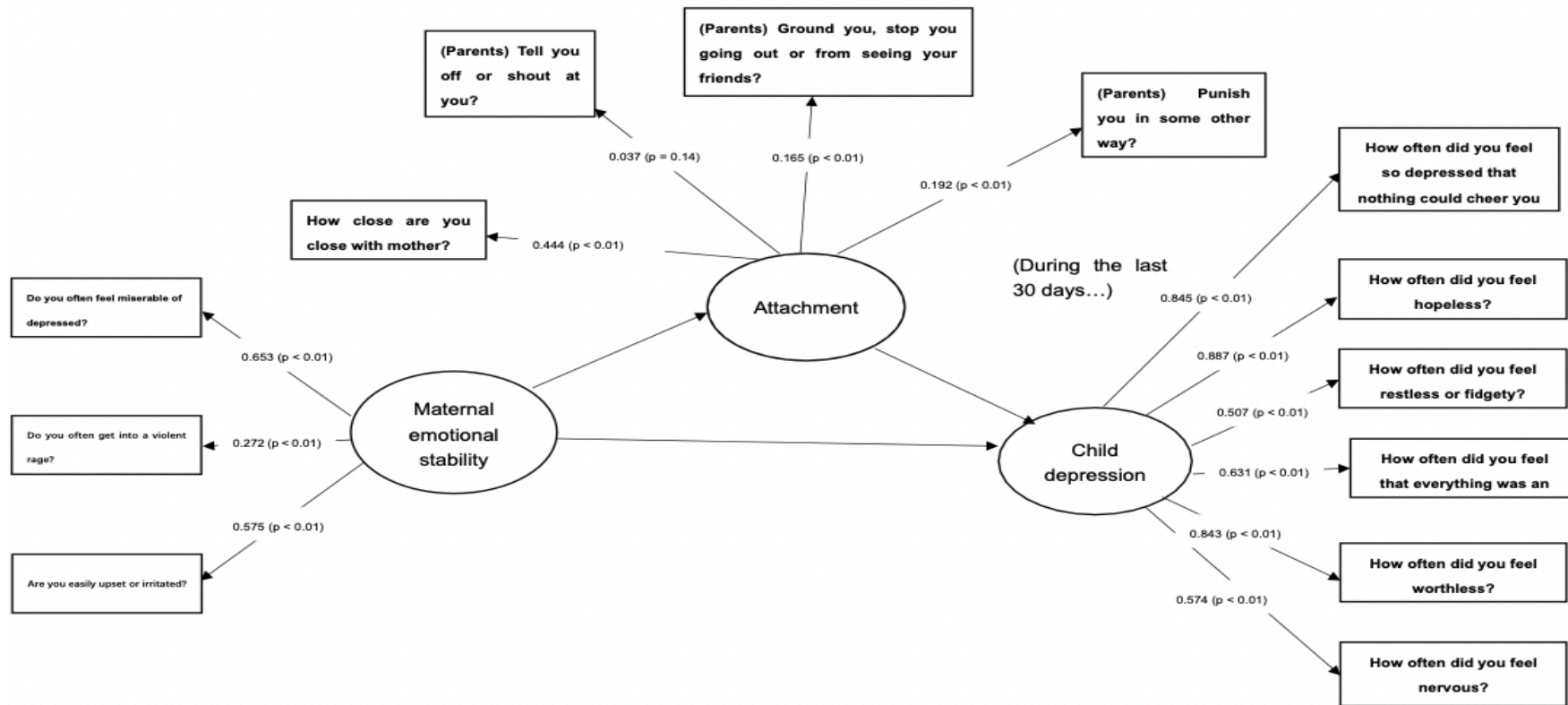


Figure 2.4: Variable loading continued*



*Loadings for each factor are consistent across the other models. In total, there are 10 models that combine different exposure-outcome combinations with the 2 different mediators.

Mediation analysis

A series of mediation analyses were conducted to measure the relationship between exposure, outcome, and mediating latent variables. Models are presented from Figure 3 to Figure 10. As a rule-of-thumb, the upper threshold for a model to be good fit is that the Chi-square and RMSEA should be below 0.05, and TLI and CFI should be above 0.90. Most of the models demonstrated good fits, with all Chi-square < 0.01 . However, there are some models had both TLI and/or CFI below 0.90 (model 4a, 5a, 7a, 8a, 8b, 8c, 8d, 9a, 9c, 9d, 10a, 10c, 10d, 12b, 12c), and RMSEA higher than 0.05 (model 3a, 4a, 5a, 6a, 8a, 8c, 8d, 9a).

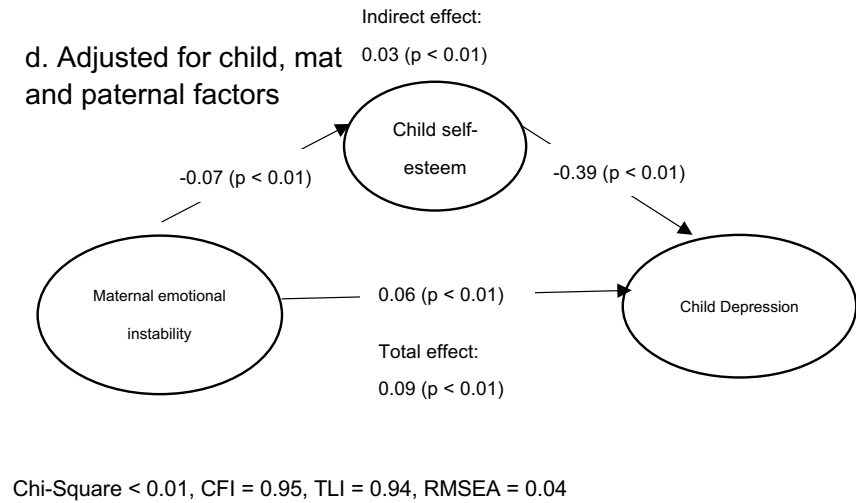
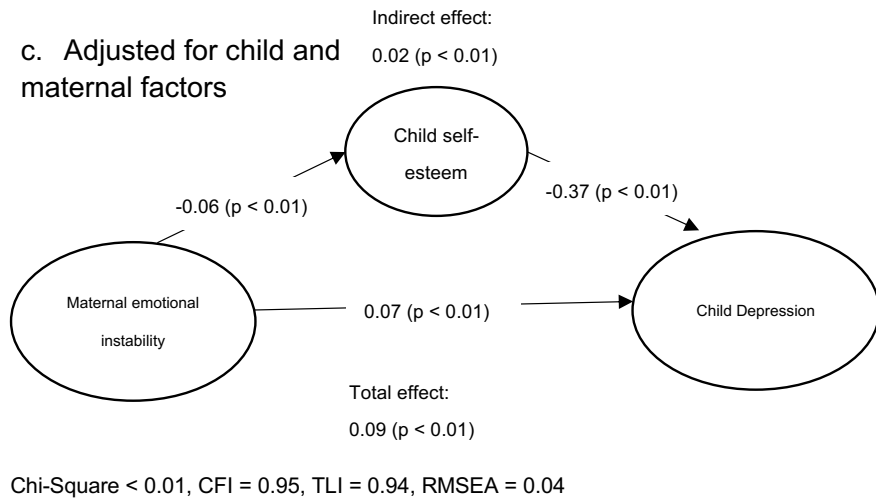
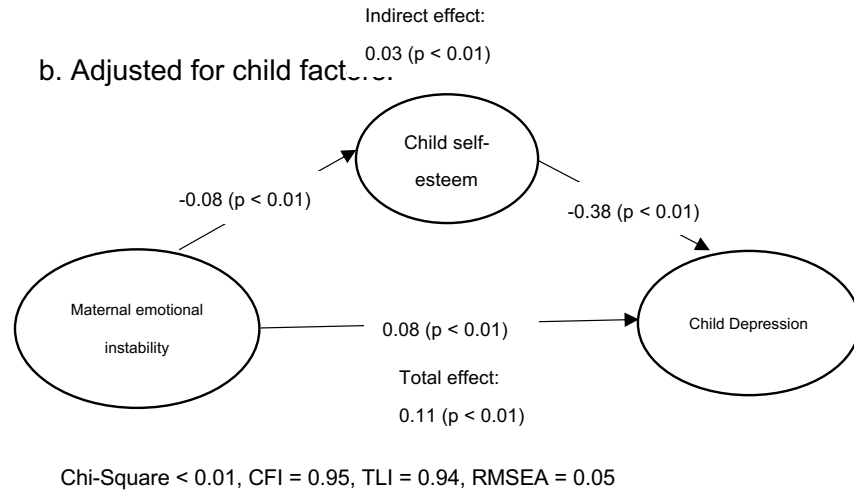
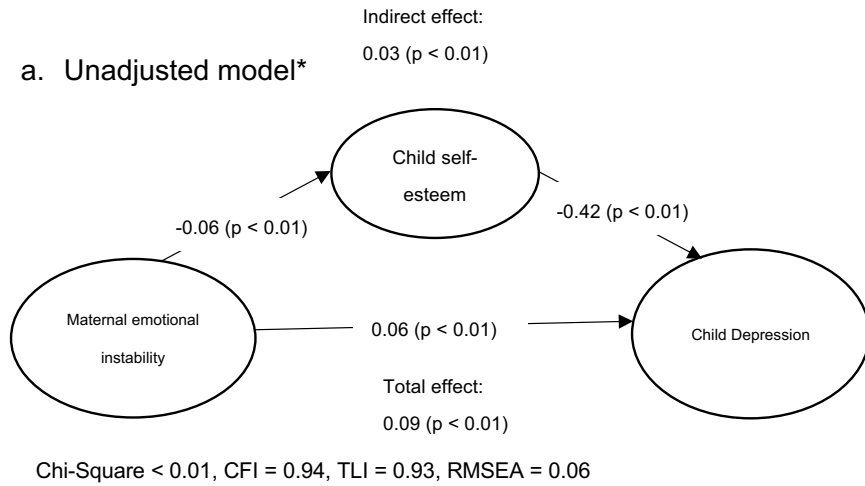
Child self-esteem as the mediator

When child self-esteem was set as the mediator, higher maternal emotional instability was significantly but weakly associated with higher child depression directly and indirectly in the unadjusted model (Figure 2.5a), but the effect size of the direct effect ($\beta = 0.06$, $p < 0.01$) was twofold bigger than the indirect effect ($\beta = 0.03$, $p < 0.01$). After adjusting for confounders, the indirect effects remained the same, except for model 2.5c, which dropped 0.1. The direct effects of 2.5b ($\beta = 0.08$, $p < 0.01$) and 2.5c ($\beta = 0.07$, $p < 0.01$) were higher than 2.5a. Higher maternal emotional instability was also weakly associated with higher child anxiety (Figure 2.7a), but only through the mediating effects of child self-esteem ($\beta = 0.03$, $p < 0.01$), the direct effect was not significant. The indirect effects remained similar after adjusting for confounding variables.

In contrast, although maternal anxiety was also associated with child depression and anxiety (Figure 2.6 and Figure 2.8), the effects were attenuated as more confounding variables were added to the models. For the unadjusted models (Figure 2.6a and Figure 2.8a), direct effects were significant but weak, but indirect effects were non-significant. However, it is interesting to note that when adjusting for child-related confounding variables, the mediating results

became significant (from non-significant in the unadjusted models), before becoming non-significant again when maternal confounding variables were added. It is possible that there was residual confounding within the model, which means that there may be other unmeasured covariates associated with maternal factors that still influence the relationship of the model (Sorjonen et al., 2021). The total transmission effects became insignificant after taking paternal mental health into consideration (Figure 2.6d and Figure 2.8d)

Figure 2.5: The direct and indirect associations between maternal emotional instability and child depression, as mediated by child self-esteem.



*These latent variables were made of the single items shown above (Figure 2.1 and Figure 2.2)

Figure 2.6: The direct and indirect associations between maternal anxiety and child anxiety, as mediated by child self-esteem.

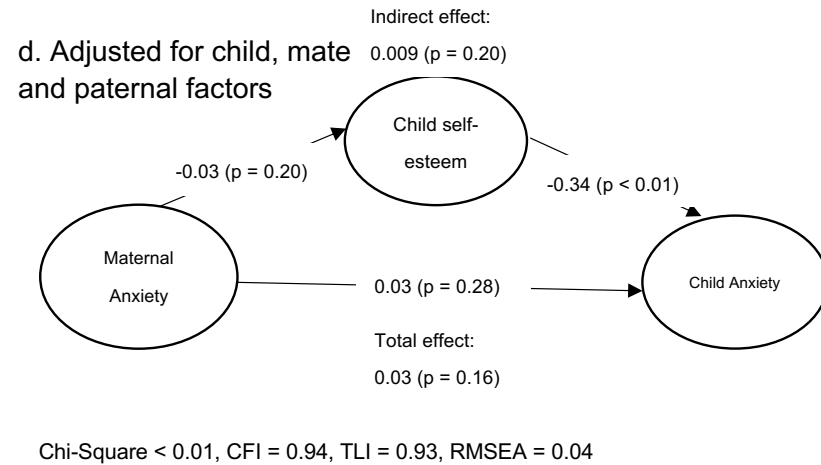
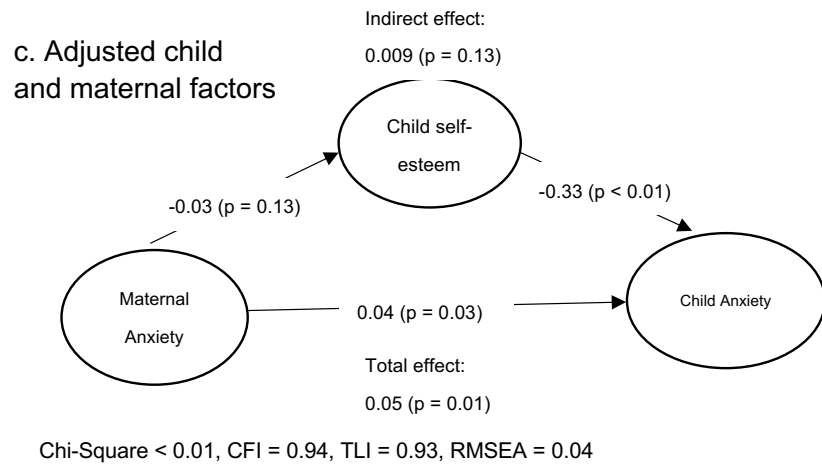
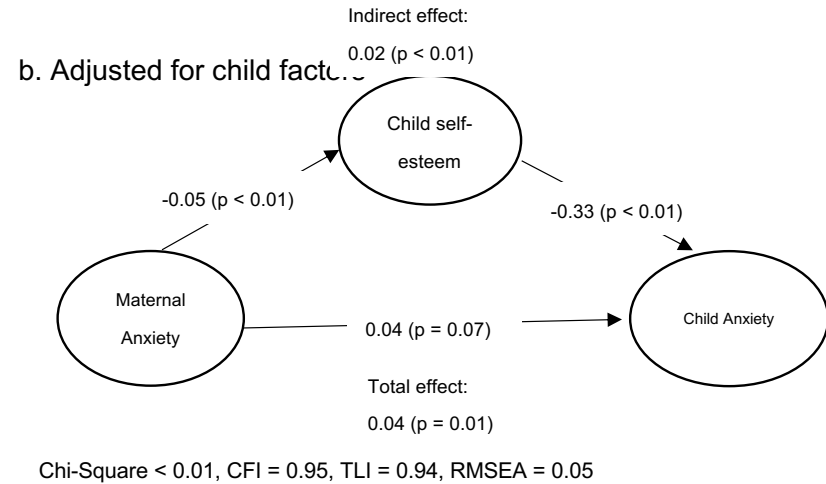
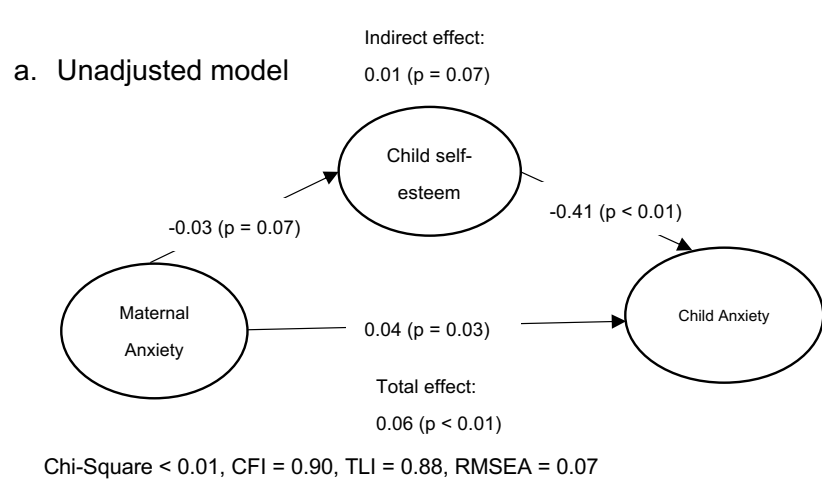


Figure 2.7: The direct and indirect associations between maternal emotional instability and child anxiety, as mediated by child self-esteem.

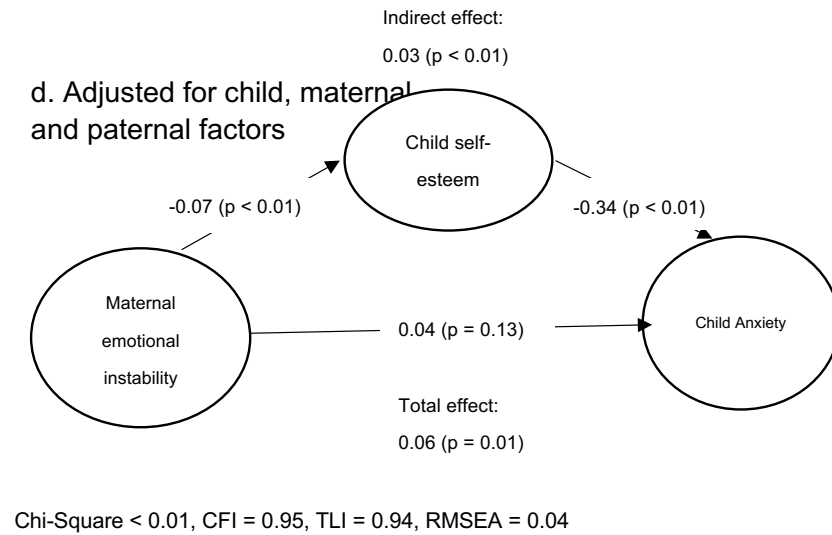
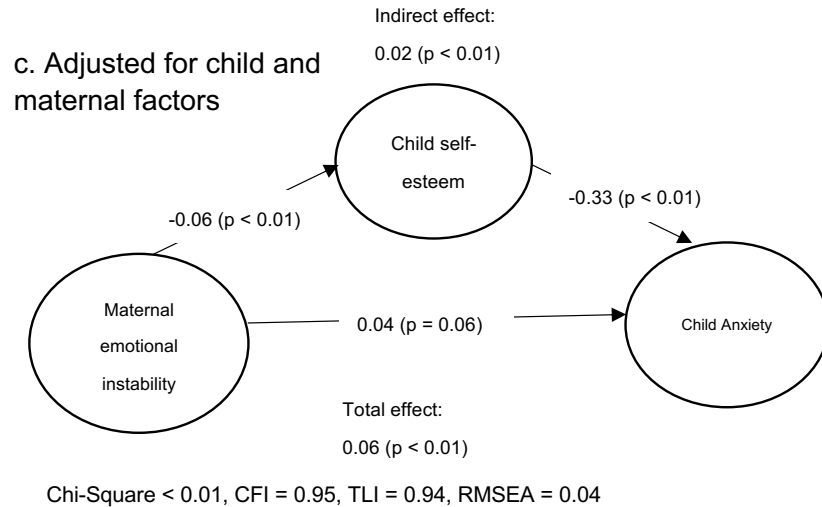
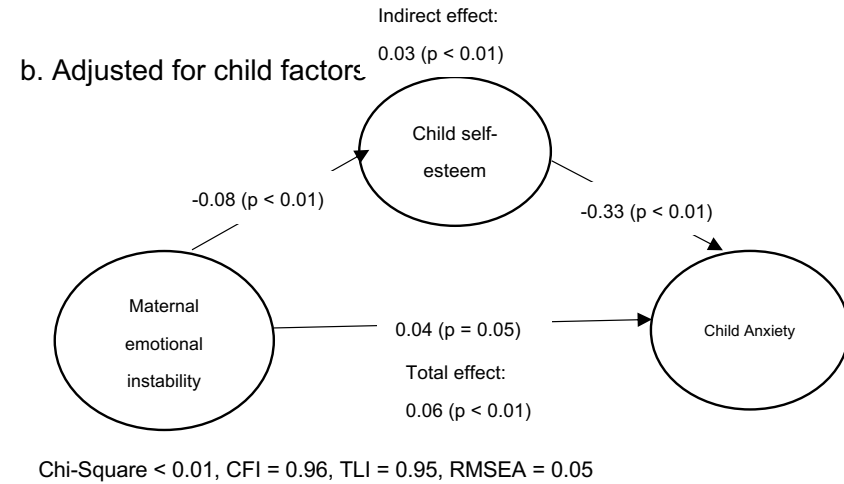
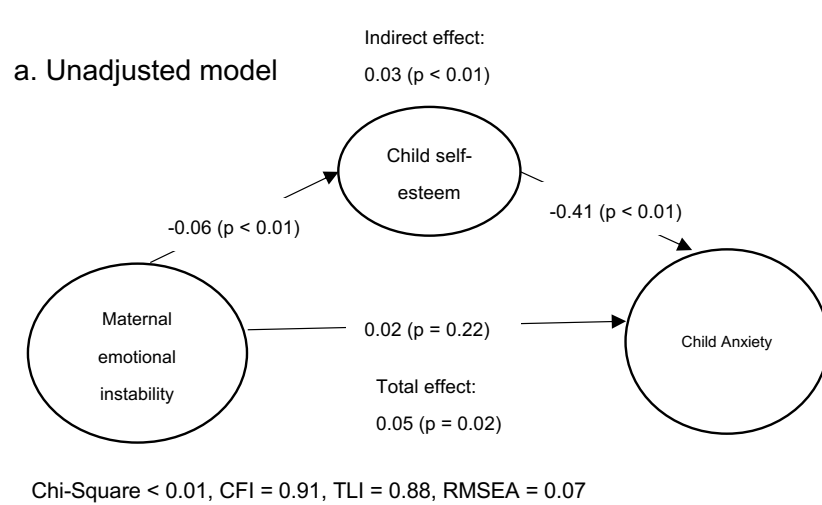
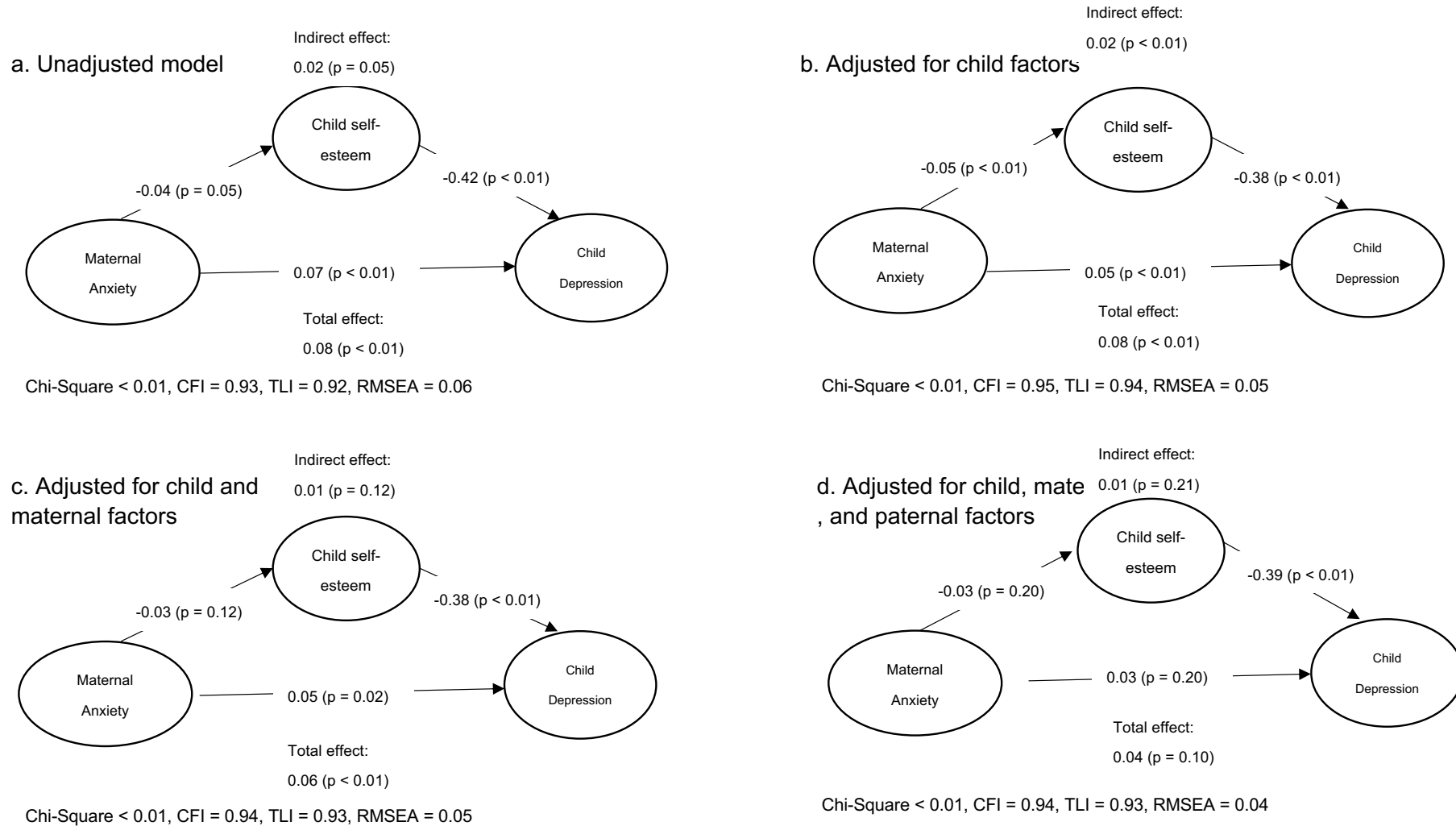


Figure 2.8: The direct and indirect associations between maternal anxiety and child depression, as mediated by child self-esteem.



Child attachment as the mediator

When child attachment was included as the mediator, maternal emotional instability was not directly associated with child depression and anxiety in the unadjusted models (Figure 2.9a and Figure 2.11a). The direct associations were then significant but weak when taking child and maternal confounders into account (Figure 2.9b, Figure 2.9c, 2.11b, Figure 2.11c). Similarly, the mediated associations were significant in the unadjusted models but became non-significant after adjusting for confounders. Maternal anxiety was only weakly associated with child anxiety when adjusting child and maternal confounding variables (Figure 2.10c). Maternal anxiety was directly associated with child depression in the unadjusted model (Figure 2.12a) and the model adjusted for child and maternal factors (Figure 2.12c). Similarly, the mediating effects from maternal anxiety were also weak in both unadjusted models (Figure 2.10a, Figure 2.12a) and the models adjusted child factors (Figure 2.10b, Figure 2.12b). After adjusting maternal and paternal factors, the mediating effects were nearly 0 (Figure 2.10c and d; Figure 2.12c and d).

Figure 2.9: The direct and indirect associations between maternal emotional instability and child depression, as mediated by child attachment.

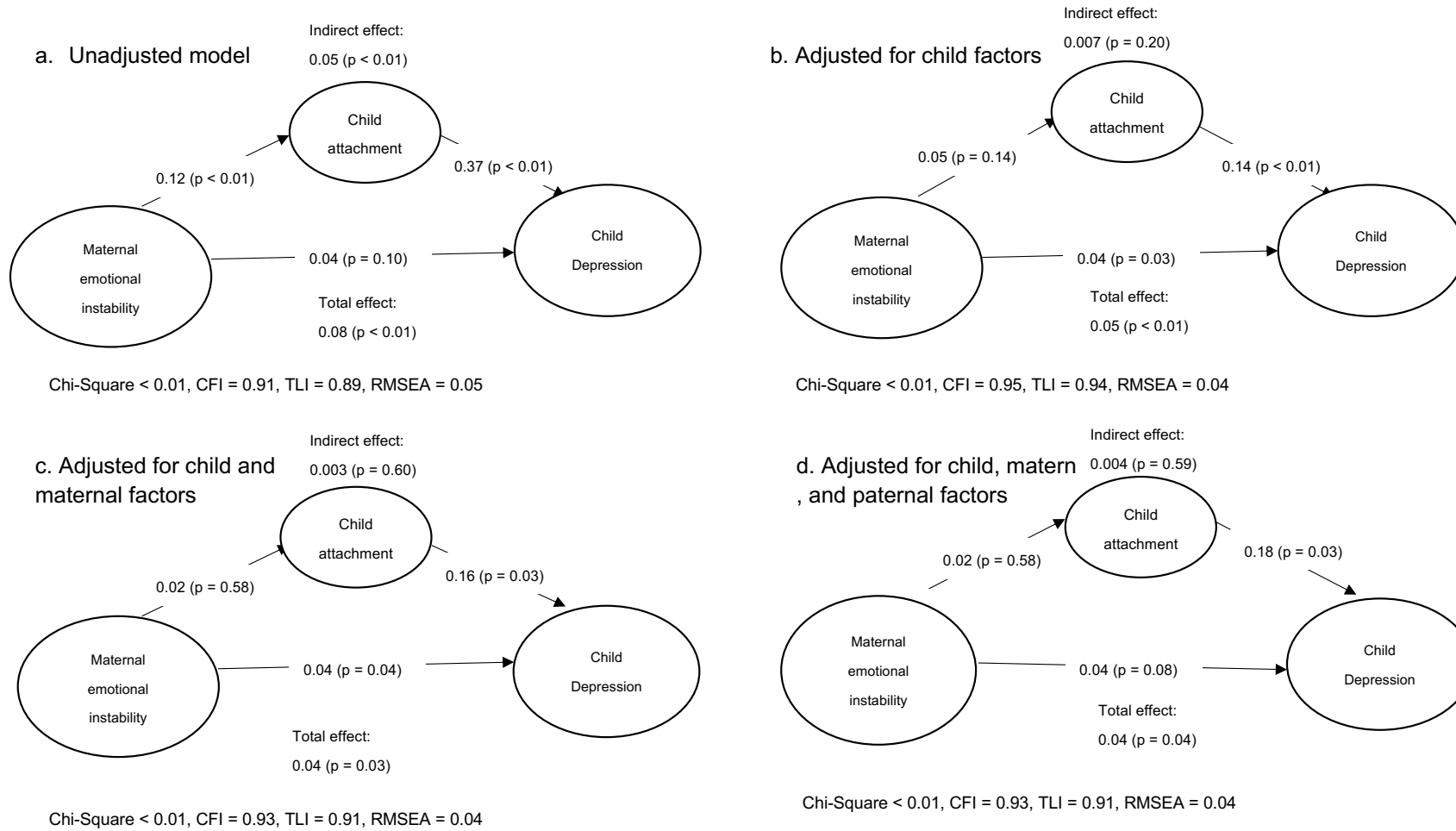
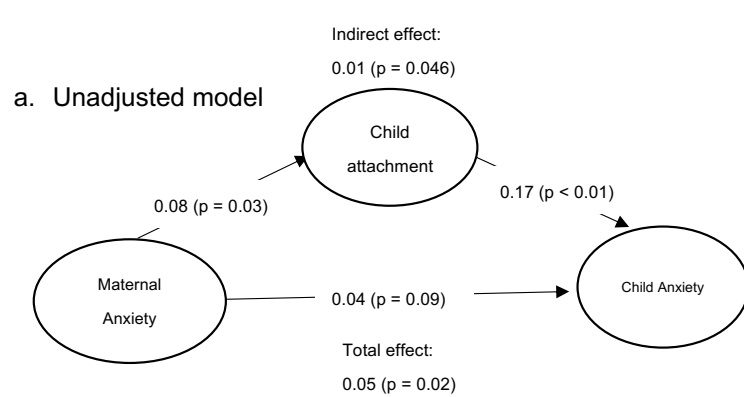
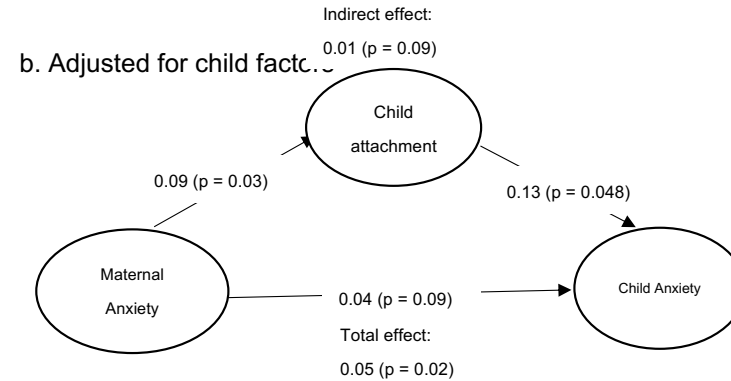


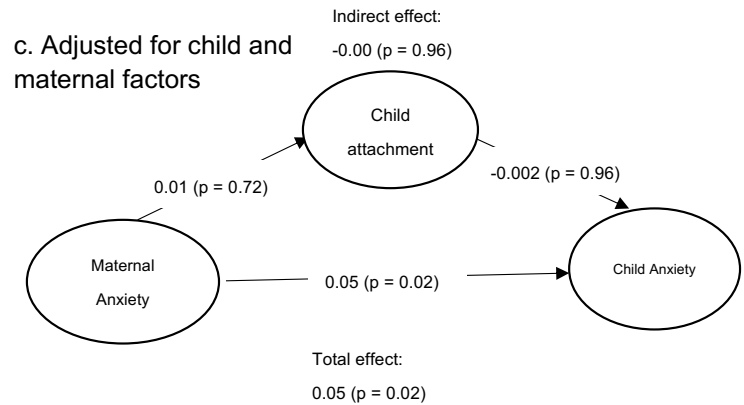
Figure 2.10: The direct and indirect associations between maternal anxiety and child anxiety, as mediated by child attachment.



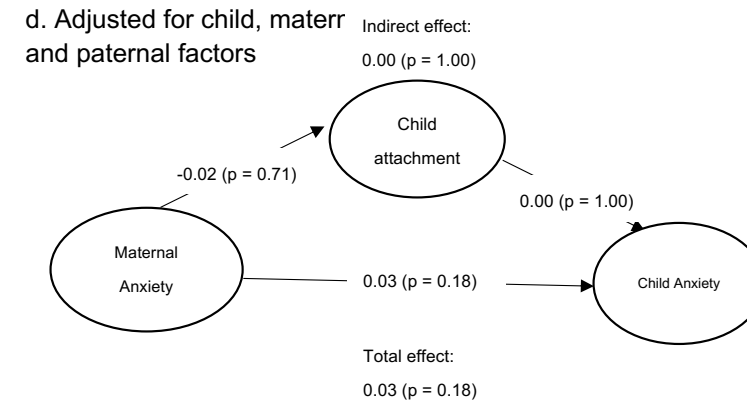
Chi-Square < 0.01, CFI = 0.75, TLI = 0.66, RMSEA = 0.07



Chi-Square < 0.01, CFI = 0.91, TLI = 0.88, RMSEA = 0.04



Chi-Square < 0.01, CFI = 0.86, TLI = 0.82, RMSEA = 0.04



Chi-Square < 0.01, CFI = 0.85, TLI = 0.81, RMSEA = 0.04

Figure 2.11: The direct and indirect associations between maternal emotional instability and child anxiety, as mediated by child attachment.

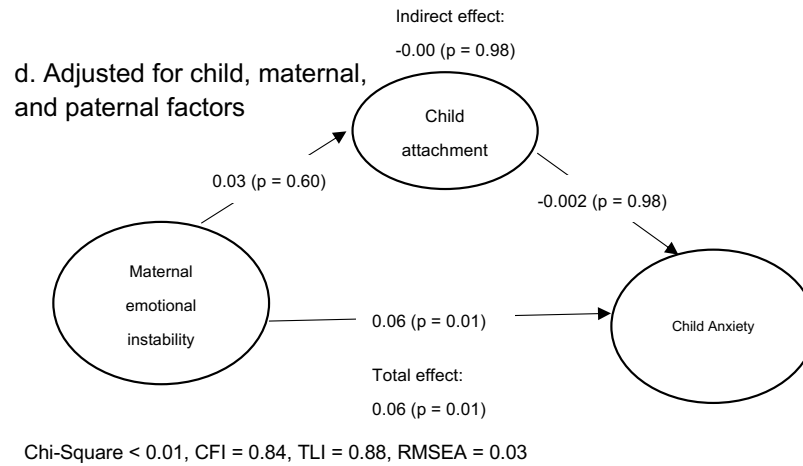
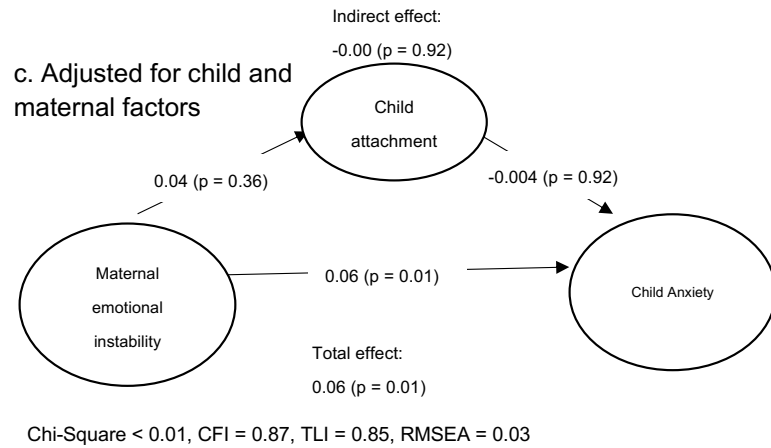
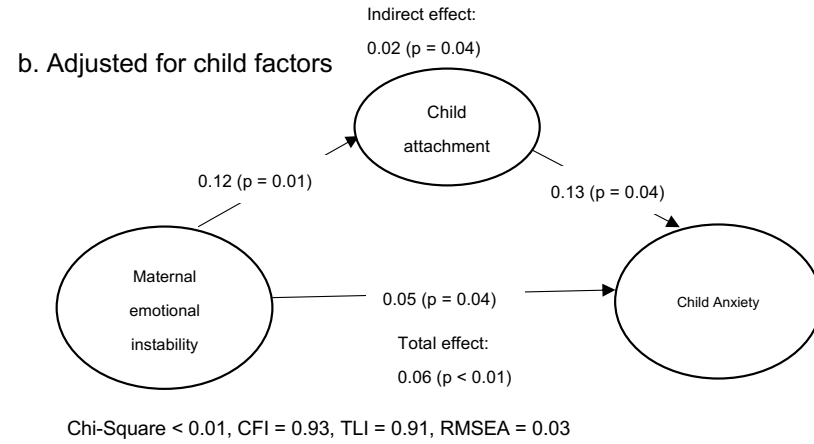
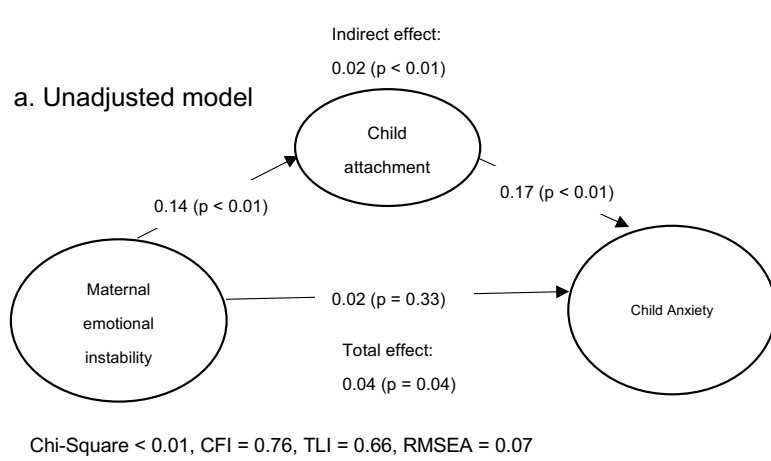
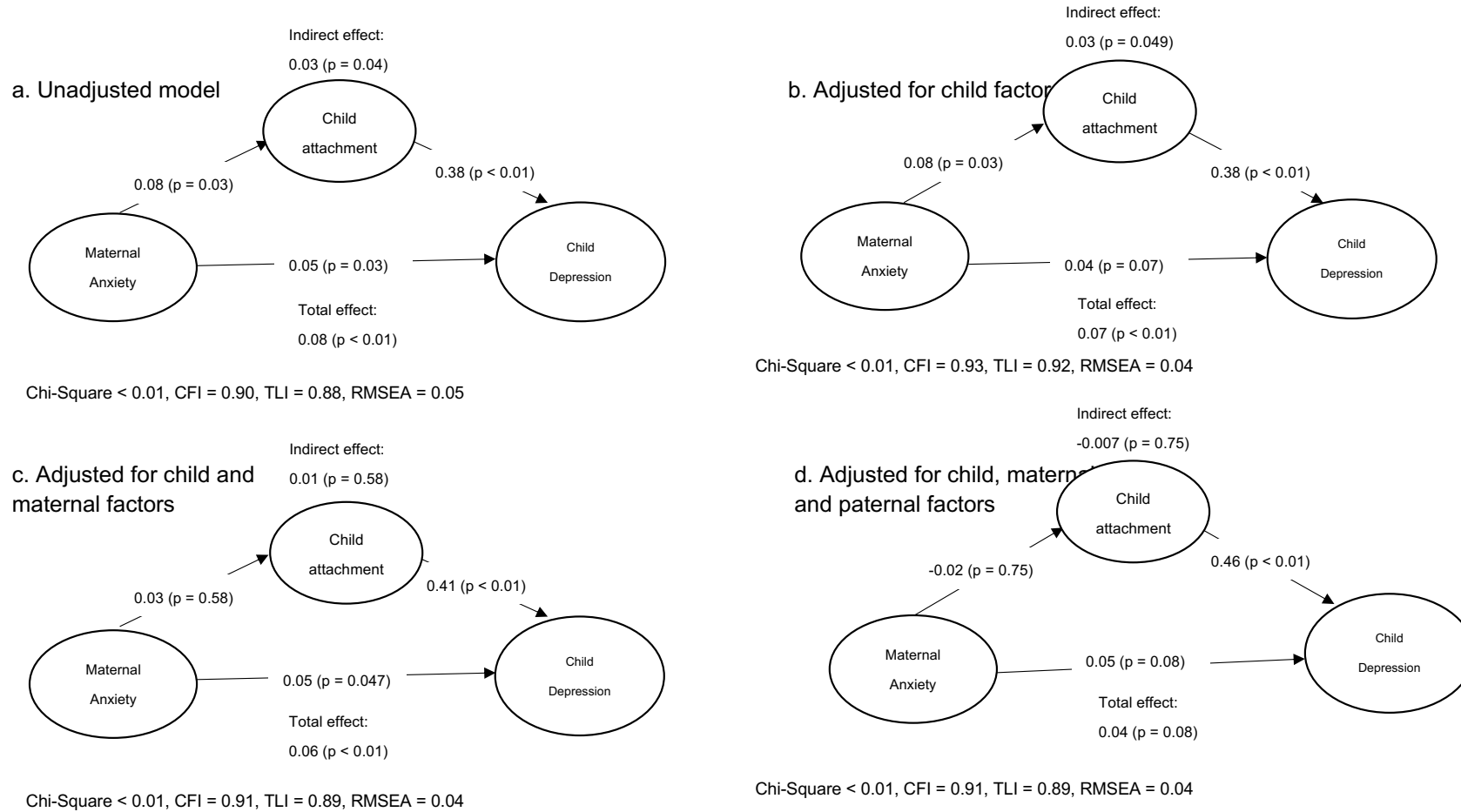


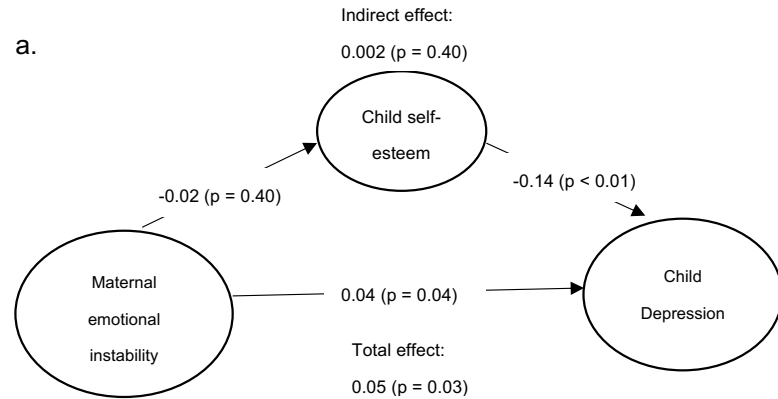
Figure 2.12: The direct and indirect associations between maternal anxiety and child depression, as mediated by child attachment.



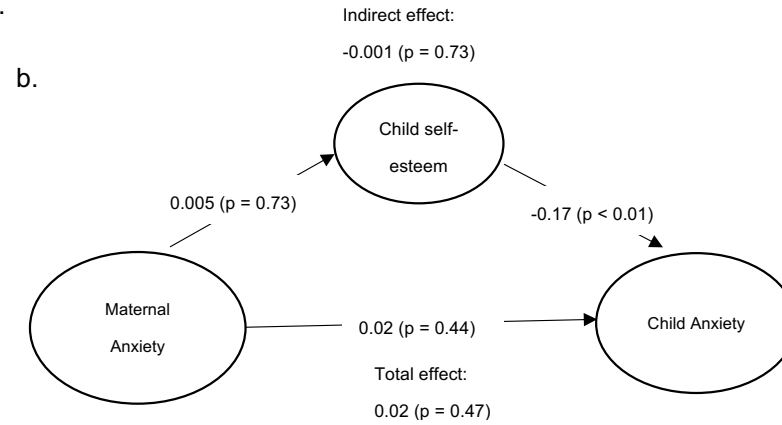
Sensitivity analysis

Sensitivity analysis in this study added child baseline mental health at age 14 years as a covariate to see how it impacted the direct and indirect associations. As shown in Figure 2.13 and Figure 2.14, most direct and indirect effects were non-significant when adding child baseline mental health into the models, with the exception of the direct association between higher maternal emotional instability effects and higher child depression (Figure 2.13a).

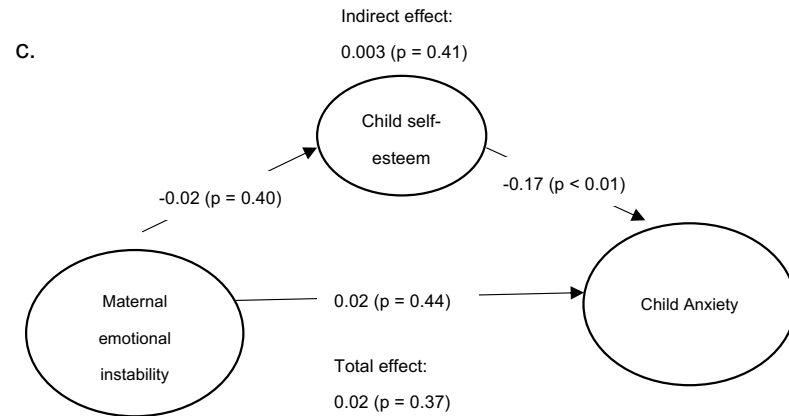
Figure 2.13: Sensitivity analyses for models mediated by child self-esteem.



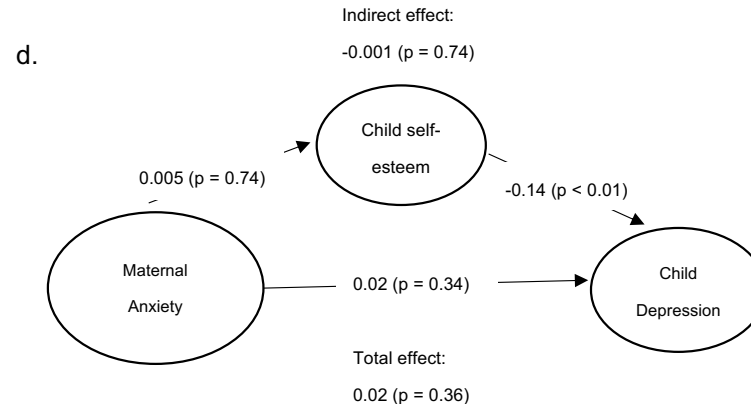
Chi-Square < 0.01, CFI = 0.95, TLI = 0.94, RMSEA = 0.05



Chi-Square < 0.01, CFI = 0.94, TLI = 0.93, RMSEA = 0.05

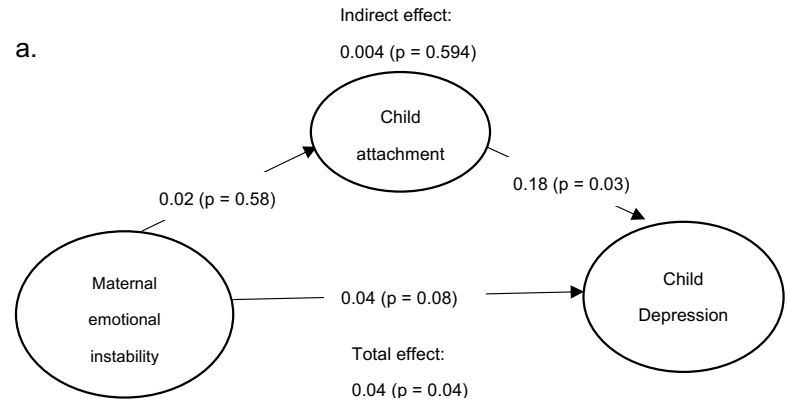


Chi-Square < 0.01, CFI = 0.95, TLI = 0.93, RMSEA = 0.05

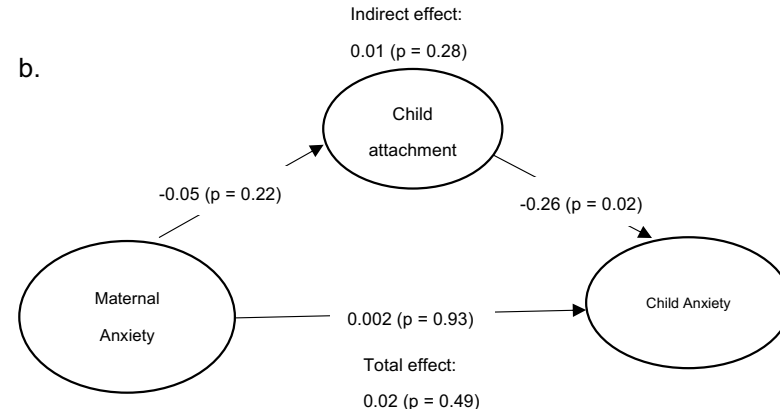


Chi-Square < 0.01, CFI = 0.94, TLI = 0.93, RMSEA = 0.05

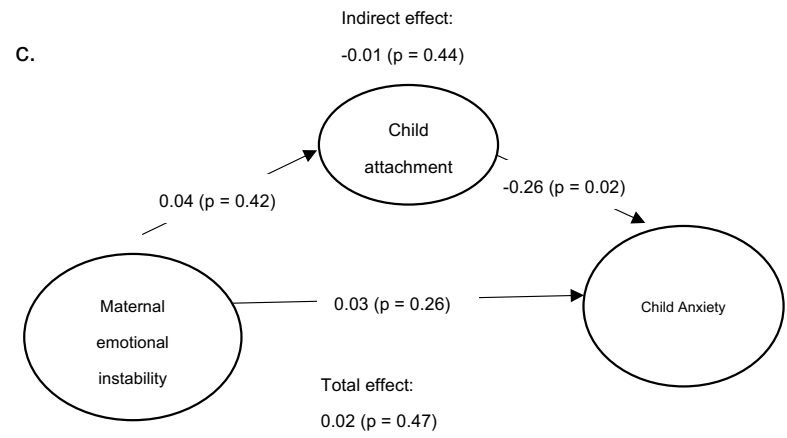
Figure 2.14: sensitive analysis for models mediated by child attachment



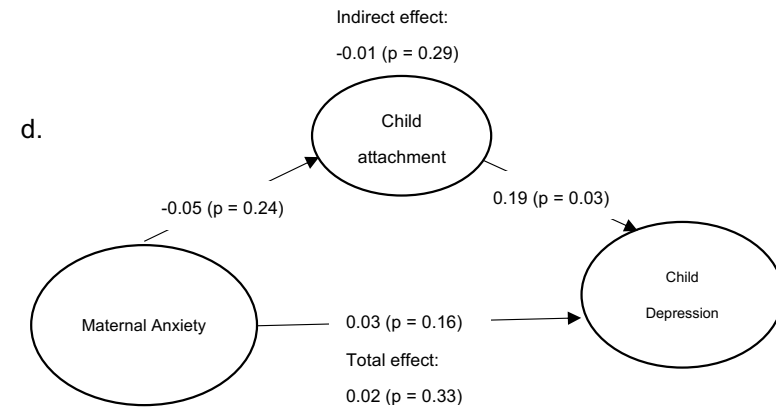
Chi-Square < 0.01, CFI = 0.93, TLI = 0.91, RMSEA = 0.04



Chi-Square < 0.01, CFI = 0.86, TLI = 0.82, RMSEA = 0.04



Chi-Square < 0.01, CFI = 0.88, TLI = 0.85, RMSEA = 0.04



Chi-Square < 0.01, CFI = 0.92, TLI = 0.91, RMSEA = 0.04

Discussion

Main findings

The current study explores the associations between maternal emotional instability and anxiety and child mental health in late adolescence, and how the effects are mediated by child self-esteem and attachment in early adolescence. This chapter expanded on chapter 1 by using more concise mental health conditions (emotional instability, depression, and anxiety), a more complex analytical method (path analysis of latent variables in Structural Equation model) and more advanced methods of dealing with missing values (including sample weights and used FIML for missing values) to explore the transmission effects between generations. Adding attachment as a mediator provides more insight into the transmission mechanisms, which have been under-researched by previous studies.

Results of the current study support the existence of direct associations between maternal mental ill-health and child mental health conditions, low self-esteem and insecure attachment. Child self-esteem and attachment partially mediated the effects of the transmission of poor mental health. Specifically, this study observed that higher maternal emotional instability was associated with more severe child depressive symptoms directly and child anxiety indirectly through the mediating effects of child self-esteem and attachment. Hence, it can be concluded that one of the mechanisms of the intergenerational transmission of mental health conditions is that maternal negative emotions negatively influence a child's self-esteem, which subsequently negatively impacts the child's mental health. Another transmission mechanism is that maternal emotional instability negatively influences the mother-child interaction and parenting behaviours, which forms the sense of negative a family environment and insecure attachment and negatively influences the child's mental health.

After adjusting for three groups of potentially confounding variables,

including child, maternal, and paternal factors, the study observed attenuation of most of the direct and indirect effects, both in strength and statistical significance, with the exception of the indirect association between maternal emotional instability and child depression with self-esteem as the mediator. This demonstrates that the confounders adjusted for were influencing the associations between the exposure and the outcome variables. Furthermore, sensitivity analysis showed that adjusting for child mental health in early adolescence made most of the direct and indirect effects non-significant. This outcome suggests that child mental health in early adolescence has strong associations with child mental health in late adolescence, which outweighs the other associations included in the models.

The findings of this study support previous studies findings that maternal mental ill-health negatively influences child self-esteem (Boudreault-Bouchard et al., 2013; Maruyama et al., 2022), attachment (Hammen, Brennan, et al., 2004; Loon et al., 2014), and child mental health (e.g., Augustijn, 2022; Hammen, Shih, et al., 2004; Zhou & Li, 2022). Boudreault-Bouchard et al (2013) used maternal emotional support as the exposure variable to evaluate its impacts on child self-esteem and mental health from the age of 14 years to 18 years using a longitudinal study, which has similar research design to the current study. They observed that a positive maternal emotional life is associated with a higher child's emotional wellbeing and high self-esteem, which supports this study's results from another direction. Loon et al (2014) explored the family relation's impact on child mental health by comparing families with and without a parent with mental ill-health, which is also similar to the current study's setting. Their results support that families with a parent with mental health conditions have less family cohesion, and less engagement with children, which are associated with worse child mental health.

Although the present study's findings are generally consistent with the previous studies, there are many non-significant and small associations compared with previous studies. For instance, Maruyama et al.'s (2022)

analysis examined the association between high maternal depressive symptoms and child emotion regulation and used child maltreatment as the mediator reporting an indirect effect $\beta = -0.05$, and a direct effect $\beta = -0.32$. None of the current study's models has indirect effects higher than 0.05 and direct effect higher than 0.1. The reason could be that this study has controlled more confounders than many previous studies. Maruyama et al. (2022) only adjusted for child gender, family income, and maternal skin colour. In this case, there could be other undetected variables in their study that have relationships with their outcome variables. To the best of my knowledge, very few previous studies have taken as comprehensive confounding variables as this study. Accounting for more covariates allowed me to better partial out variance in transmission, as did splitting it up into direct and indirect associations. This allows the current study to better estimate the contribution of maternal mental health.

Strength and limitations

Compared to chapter 1, this study improved the specificity of variables and more precise research methods. Specifically, instead of using psychological distress, chapter 2 broke down the variables used in chapter 1 and specified them as emotional instability, anxiety, and depression. This measure sheds light on what specific maternal mental health symptoms impact the specific aspect of the child mental health. In addition, this study used Full Information Maximum Likelihood (FIML) to deal with missing values. Compared with the list-wise deletion method used in chapter 1, FIML retains more statistical power and provides more unbiased estimations, because it is based on maximum likelihood estimation on all available data, including the missing values. Instead, list-wise deletion only uses data that has complete cases, which could neglect important statistical information within those data that only have a small number of missing values.

One of the main limitations of this study is that some observed variable

loadings for the latent variables were low. As discussed above, child attachment, child anxiety, maternal emotional instability, and maternal anxiety had moderate to weak observed variable loadings compared with child self-esteem and child depression. This indicates that the observed variables, compared to those having strong variable loadings, can only moderately or weakly indicate the latent variables. The potential reason could be that the variables used for measuring depression and anxiety in this study are not designed specifically for depression or anxiety disorder. Because the original scale was not designed for the specific disorders, variables selected from them may not be as precise as the existing diagnostic scales, even if they conceptually fit the latent variable. This could also be the reason why the observed variable loadings from the two latent variables that used the entire scale had strong loadings, as they are specifically designed to measure self-esteem and depression. Thus, future studies can broaden this research by using clinically diagnostic measures, such as Patient Health Questionnaire-9 (PHQ-9) for depression (Manea et al., 2015) and General Anxiety Disorder-7 (GAD-7) for anxiety disorder (Johnson et al., 2019) to enhance specificity and reliability of this study.

Another limitation within data analysis is the residual confounding. Within some models, certain effects were non-significant in the unadjusted model but then became significant when taking confounders into consideration (e.g., Figure 7). One possibility is that the confounders included have strong associations with the outcome variables, which outweighed the effects from exposure variables or mediators. In addition, the result section demonstrated that some models have CFI and TLI below 0.90 and RMSEA above 0.05. Generally, CFI and TLI > 0.90 and RMSEA < 0.05 are the high thresholds for a model to be well-fit (UCLA, 2021). Poor fit in the present study could be model overfitting, which means that the models observed not only the data's underlying patterns but also the random noise of the observed dataset. Given that this study adjusted for many covariates, these covariates' association effects with the outcome variables can demolish the effects from the exposure

variables. CFI and TLI are incremental fit indices which measure how the model fits compared with the worse fit model i.e., variables have completely no relationship. Whereas RMSEA and Chi-square are absolute fit indices that examine how the model fits into the actual data. In this case, given the significant Chi-square values, the models in this chapter fit relatively well into the data. Thus, despite the limitation, the models in this chapter cannot be invalidated. Future studies could add one confounder at a time, testing for problems with model fit at each stage.

Conclusion

In conclusion, this study explores mental health transmission from maternal emotional instability and anxiety at child age of 9 months to child depression and anxiety symptoms at child's age of 17 years. In addition, it also examined the mediating effects of child self-esteem and child attachment at age 14 years. The results suggest that maternal emotional instability significantly influences symptoms of child depression and anxiety in children's age of 17 years. Maternal anxiety also negatively impacts child mental health, but its effect sizes were smaller than emotional instability. Findings also indicate that children's self-esteem and attachment can partially mediate the effects of mental ill-health transmission. This study took several confounding variables into consideration, and all direct and mediated transmission paths were attenuated as more confounding variables were added. However, this study was limited by the use of non-diagnostic measurements and some weak model fits. Future research can use diagnostic questionnaires to attempt to replicate this study to ensure the construct validity.

General Discussion

Overview

The aim of this thesis was to explore the intergenerational transmission of mental health from maternal psychological distress in early childhood to child mental health and wellbeing in late adolescence. It also examined the mediating role of child self-esteem and child attachment within transmission paths. The hypotheses were that there will be positive associations between early maternal psychological distress and greater child mental health symptoms in late adolescence, and that child self-esteem and attachment mediate the effects of transmission. This thesis attempted to test these hypotheses by reviewing the scientific literature on maternal mental health's impact on child mental health, self-esteem, and child attachment, and how child self-esteem and attachment are associated with child mental health (literature review chapter). It used mediation analysis to explore the association between maternal psychological distress at the child's age of 9 months and child psychological distress, wellbeing, internalising, and externalising problems at the child's age of 17 years, with the child self-esteem at the age of 14 years as a mediator (chapter 1). Following that, the thesis breaks down the variables in chapter 1 to explore how maternal emotional stability and anxiety at the child's age of 9 months were associated with the child depression and anxiety symptoms at the age of 17 years, and whether the child self-esteem and attachment at the child's age of 14 years mediated these associations (chapter 2). Both analytic chapters controlled for several covariates which were grouped into child, maternal, and paternal factors. Sensitivity analysis was performed to evaluate the influence of child mental health at age 14 years on the transmission models. A summary of the analytic chapters' findings is presented in Table 3.1. The rest of this chapter will discuss how the findings of this thesis link with previous literature. After that, it will discuss the finding's implications for practice. It will also introduce the

limitations of the analyses performed and thoughts about future work.

Table 3.1: Results summary

	Child psychological distress	Child psychological wellbeing	Child internalising problems	Child externalising problems
Significantly associated with maternal psychological distress?	Yes (positive)	Yes (negative)	Yes (positive)	Yes (positive)
The effects still significant after adjusting child, maternal, and paternal factors?	Yes (positive)	Yes (negative)	Yes (positive)	Yes (positive)
The effects still significant after sensitivity analysis?	Yes (positive)	Yes (negative)	Yes (positive)	Yes (positive)
Are the effects significantly mediated by self-esteem?	Yes (positive)	Yes (negative)	Yes (positive)	Yes (positive)
The effects still significant after adjusting child, maternal, and paternal factors?	Yes (positive)	Yes (negative)	Yes (positive)	Yes (positive)
The effects still significant after sensitivity analysis?	No	No	No	No
	Child Depression (Self-esteem as mediator)	Child Anxiety (Self-esteem as mediator)	Child Depression (Attachment as mediator)	Child Anxiety (Attachment as mediator)
Significantly associated with maternal emotional stability?	Yes (positive)	No	Yes (positive)	No
The effects still significant after adjusting child, maternal, and paternal factors?	Yes (positive)	No	No	Yes (positive)
The effects still significant after sensitivity analysis?	Yes (positive)	No	No	No
Are the mediating effects significant?	Yes (positive)	Yes (positive)	Yes (positive)	Yes (positive)
The effects still significant after adjusting child, maternal, and paternal factors?	Yes (positive)	Yes (positive)	No	No
The effects still significant after sensitivity analysis?	No	No	No	No
Significantly associated with maternal anxiety?	Yes (positive)	Yes (positive)	Yes (positive)	No
The effects still significant after adjusting child, maternal, and paternal factors?	No	No	No	No
The effects still significant after sensitivity analysis?	No	No	No	No
Are the mediating effects significant?	No	No	Yes (positive)	Yes (positive)
The effects still significant after adjusting child, maternal, and paternal factors?	No	No	No	No
The effects still significant after sensitivity analysis?	No	No	No	No

Considerations

Research chapter 1 builds on previous intergenerational transmission of mental health studies in two areas. First, studies to date have observed the negative association between maternal mental ill-health and child self-esteem (Hosogi et al., 2012), and the negative association between child self-esteem and child mental health conditions (Orth et al., 2008). But few studies have linked these together to explore the mediation effects of self-esteem on transgenerational mental health. The mediation analyses in chapter 1 suggest that a child's self-esteem partially mediates the associations between maternal psychological distress and child mental health. But care should be taken when interpreting the results of chapter 1 because the mediating effects were non-significant after adjusting baseline mental health in early adolescence. In this case, it is possible that child self-esteem in early adolescence is also a component of mental health. Therefore, controlling for mental health could potentially diminish the observed impact of self-esteem, rendering it non-significant. Second, previous studies usually focus on condition-to-condition transmission (e.g., Gotlib et al., 2020) or wellbeing-to-wellbeing transmission (e.g., Augustijn, 2022). Comparatively, fewer studies have looked at how maternal mental ill-health can influence the child's psychological wellbeing. However, chapter 1 also left some questions unanswered, such as what mental health symptoms represent the psychological distress.

An important advantage that chapter 2 has over chapter 1 is that it explored associations between specific symptoms, such as depression, anxiety, and emotional instability. In addition, chapter 2 extends the mediated model applied in chapter 1 to examine the transdiagnostic transmission of mental health. The underlying idea of transdiagnostic transmission is that the symptoms of one disorder can become a risk factor for another disorder within and between individuals i.e., common vulnerability between disorders (Harvey, 2004). For example, recurrent negative thinking is a common symptom observed in both

anxiety disorder and depression (Harvey, 2004). Hence, having depression can increase the risk of developing anxiety symptoms. It is possible that it is the common symptoms of mental health conditions contributes to intergenerational transmission because these symptoms are associated with each other. For example, negative attentional processing (e.g., selectively noticing any negative facial expressions) in mothers can be developed by daughters, increasing their vulnerability to acquiring transmitted symptoms (Joormann et al., 2007). In this case, the mother has the attentional bias impacted by her mental health symptoms (e.g., depression and anxiety), and this attentional bias is learned by her daughter, which increases the risk of the daughter developing similar mental health symptoms. Chapter 2's results support this view and demonstrate that maternal emotional instability and maternal anxiety are associated with both child depression and child anxiety, either directly or mediated. This suggests that the transmission of maternal mental health conditions to child conditions is not a straightforward and a one-to-one process.

The two research chapters' findings are generally consistent when taking them together. Both of them suggest that maternal mental health conditions are associated with child mental health in late adolescence, which were partially mediated by child self-esteem and attachment in early adolescence. Since chapter 1 used list-wise deletion to deal with missing data, the consistent results from chapter 2 using the updated FIML method suggest that chapter 1's results are reliable. Furthermore, the two chapters' findings are consistent with previous studies' findings. Maternal mental health conditions, including depression and anxiety, at a child's early age are associated with the child's later ages' depression (Hammen, Shih, et al., 2004; Pearson, Evans, et al., 2013), anxiety (Aktar, 2022; Aktar et al., 2017; Wald et al., 2018), low self-esteem (Boudreault-Bouchard et al., 2013; Lim et al., 2015; Peng et al., 2021), negative parenting behaviours (Hammen, Brennan, et al., 2004; Loon et al., 2014), and reduced wellbeing (Augustijn, 2022). In addition, a child's mental health conditions are associated with the child's low self-esteem (Keane &

Loades, 2017; Orth et al., 2008; Orth et al., 2012) and insecure attachment (Elgar et al., 2007; Zhou & Li, 2022). Thus, the consistent findings from the thesis's two chapters highlighted the mechanisms of intergenerational transmission of mental health: through influencing child self-esteem and attachment.

This thesis used longitudinal data from the child's age of 9 months, 14 years, and 17 years (except the baseline mental health adjusted at child's age of 3 years). These time points were chosen to align with key developmental periods specified in the hypotheses: early childhood, early adolescence, and late adolescence. The choice of the 17-year time point is significant as it falls just one year before adulthood, which is a critical time point for adolescents to make decisions about their future, including admission to university, career plan, or intimate relationship. Since adolescence is a sensitive period for child cognitive development, understanding adolescents' mental health at this stage could be crucial for mental health development beyond adulthood. Following that, child's age of 14 years is when children start connections beyond their family. This time is very important for child's mental health and self-esteem development. Finally, according to attachment theory (not the attachment variable used in this thesis), infant and early childhood period of mother and child interaction is crucial for the attachment between child and mother (Cassidy & Shaver, 2016). Therefore, the three time points in this thesis are consistent with the developmental milestones of child and adolescent and could shed lights on mental health transmission within adolescence and even beyond adulthood.

Implications

Ultimately, the purpose of doing mental health transmission research is to find out more effective ways of intervening in mental ill-health and break the chain of transmission. The results so far suggest that maternal psychological distress and child self-esteem are important for mental health development

during adolescence. These findings have two main implications for interventions. First, the significant associations between self-esteem and child mental health and wellbeing suggest that prevention and intervention measures aimed at boosting child self-esteem can both prevent the onset of psychological disorders and reduce symptom burden. Although current Cognitive Behavioural Therapy, a common intervention offered to young people with mental health conditions, includes work to enhance self-esteem to reduce symptoms of depression and anxiety (Zeigler-Hill, 2011), the focus is on the symptoms rather than self-esteem. More advanced approaches targeting boosting self-esteem can have exceptional outcomes for adolescent and young adult mental health development and psychological wellbeing.

Second, given the findings from chapter 2, interventions may benefit from targeting transdiagnostic contributions to intergenerational transmission. Transdiagnostic contributions refer to factors that are relevant across multiple mental health conditions and can influence the transmission of these conditions from one generation to the next. Taking an example from Joormann et al. (2007), girls with mothers who have depressive symptoms selectively attend to negative emotional faces rather than to positive emotional faces, compared with girls with mothers without this condition. Selective attention, a tendency to concentrate on negative or threat-related information, is a common symptom of both depression and anxiety disorders (Harvey, 2004). Within the context of transgenerational mental health, interventions targeting solving this shared behavioural pattern could be more effective in addition to focusing on the individual symptoms of depression and anxiety.

Given the associations of maternal emotion, anxiety, and harsh parenting behaviours with child mental health, boosting maternal mental resilience could be beneficial for the mental health and wellbeing of both mothers and children. Resilience in mental health refers to strong adaptability within the influence of adverse stimuli (e.g., stressful life events) (Luthar et al., 2000). One study comparing people with high and low levels of resilience demonstrated that

highly resilient people's psychiatric symptoms remain stable when encountering stressful events, whereas lower resilience participants show increased symptoms of depression and anxiety (Hjemdal et al., 2006). Combining these with the current study's results, mothers with higher levels of resilience may have more stable emotions and less negative reactions when facing life adversities, helping those with mental health conditions to manage their symptoms. This resilience may in-turn reduce the chances that mothers show emotional instabilities or anxious behaviours when interacting with their children, decreasing children's exposure to negative behaviours that might increase the risk of transmission and potentially breaking the chain of mental health transmission. Given the importance of child attachment and family environment, lower levels of negative emotion within mother-child interactions may create a better environment and enhance the level of attachment, which reduces the child's mental health symptoms and can potentially decrease the risk of transmission.

Limitations

Chapter-specific limitations have been discussed within each chapter. In this part, I will discuss more general limitations and how they impact this thesis.

First, the maternal data used was named 'main carer' in the MCS dataset, and paternal data was named as 'partner'. Traditionally, mothers are the main carers of the children, and her partner is often assumed as the children's father. However, since there are no specific indications about whether the main carer examined was the mother, there may be cases that the 'main carer' is not the mother, but other family members. Moreover, there are no indications on the structure of the families. Specifically, except the traditional mother-father-child family, there are other possible constructions of families, e.g., mother-mother family or father-father family. These variations can influence the conclusions. Specifically, if the maternal data used in this thesis consists of both the mother

and the father's mental health data, the conclusion becomes "parental or caregivers' mental health has associations with child mental health."

In addition, overall small effect sizes from the correlation and mediation analyses suggest that there are other important factors associated with the child mental health at the child's age of 17 years. Chapter 1's correlation analyses showed weak correlations between maternal psychological distress and child mental health and wellbeing. Both chapter 1 and chapter 2's mediation analyses showed small effect sizes, which further decreased as more confounders were adjusted for. These small effects indicate that the associations between predictor, mediator, and outcome variables were weak. One of the reasons for these weak associations may be that there are other unmeasured factors that are important and can explain the associations between the variables. For example, both chapters' sensitivity analysis displayed non-significant indirect effects when adding child mental health at age 14 years as a covariate, and the direct effect sizes became smaller. And in chapter 2, some associations became non-significant after adjusting for child, maternal, and paternal confounders. The analyses were restricted by the limited availability of potentially important covariates within the MCS dataset. For example, previous studies demonstrated that stressful life events experienced at a child's early age can increase the risk of developing mental health conditions (Arnau soler et al., 2019; Colodro-Conde et al., 2018). Given the potential association, children experiencing stressful life events could be a potential confounder within the transmission paths. However, the MCS does not contain any data that measures child stressful life events. Thus, important confounding effects could be missed because of excluding these variables from the studies.

Although the MCS has tried to reduce sampling bias by oversampling from Scotland, Wales, and Northern Ireland, and minority ethnic groups, it can be seen that sample ethnicity is not representative of all ethnic groups, as 82% of participants were White. This skewed sample can bias the results, as the

findings could only represent the cognition, behaviour, and other psychological effects in White people. Other minority groups may have unique cognitive or behavioural patterns that are different from other groups. In this case, it is difficult to apply this thesis's findings to other minority groups, as they were underrepresented in the dataset.

Similar to other studies, this study is limited by participant attrition and missing data over time. As shown in the descriptive statistics, the sample at age 3 years included 14922 participants out of 19450 within the original cohort. At age 14 years, the sample was reduced to 11176, and at age 17 years, it was further reduced to 10060 for child psychological distress. Despite this, the attrition rate in this study (49%) is similar to other longitudinal design studies (Callaway et al., 2007) in which 7223 samples were initially in the cohort, but only 3572 (49.9%) contained the data (BMI) required.

The current thesis only considered environmental effects on children's psychological distress. However, it is important to acknowledge that child psychological distress can also be subject to genetic effects (Kwong et al., 2021; Pearson, Evans, et al., 2013). Studies have demonstrated that mental health intergenerational transmission is a combination of both genetic and environmental effects (Arnau soler et al., 2019), and these effects are not merely additive, but that they interact. The current study only showed weak correlations between maternal psychological distress and child mental health. It is possible that genetic effects also correlate with the child mental health and self-esteem, but this is not tested in this study. Therefore, future research can take genetic information into consideration to explore maternal genetic and environmental impacts on offspring.

Although this thesis used longitudinal data, it only contains four time points of data collection (9-months, 3 years, 14-years, and 17-years). Before children's age of 14 years, there were four more sweeps of data collection taking place, including at the child's age of 5, 7, and 11 years, which were not used in this thesis. Previous studies have explored the connection between early maternal

psychological distress and children's internalising and externalising problems at the children's of 7 and 11 years (Loeber et al., 2009). In this case, omitting these data from the analysis could potentially miss important insights of mental health transmission. More importantly, using all sweeps before the age of 17 years could produce a more comprehensive examination of the bidirectional trajectory of mental health transmission, encompassing both the influence from mother to child and from child to mother.

Future research

This thesis expands upon existing literature on the intergenerational transmission of mental health. However, there are still unanswered question that requires further research.

First, the current thesis used children's data up to the age of 17 years. The MCS has three more follow-up sweeps of data collection, which took place during the Covid-19 pandemic when children were aged 19 to 20 years. Future studies could follow up the current thesis by tracking the participants' mental health status as they enter adulthood and during the pandemic. This can provide a comprehensive understanding of the longitudinal effects of early maternal psychological distress's influence on the children's mental health trajectory. Specifically, it helps to see whether maternal mental health in early childhood has lasting effects beyond adulthood. It could also help evaluate if the Covid-19 pandemic could be another mediator within the transmission paths.

Second, the implication section mentioned the potential transdiagnostic approach of exploring mental health transmission and the role of common symptoms. Currently, studies have identified many cognitive symptoms coexist in different psychological disorders, such as attentional bias, recurrent thinking, and avoidance behaviours (Harvey, 2004). However, exploring how the common cognitive and behavioural symptoms are transmitted within families is still at an early stage. In addition, existing longitudinal data cohorts may not

have relevant measures about these factors (e.g., the MCS). Therefore, future studies can broaden this idea by gathering first-hand data or finding a dataset that contains cognition-related variables to explore the transdiagnostic effect of transgenerational mental health.

This thesis only included the unidirectional transmission of mental health conditions within the family i.e., from maternal mental health to child mental health. However, it is important to note that mental health dynamics within families often involve bidirectional transmission, which means that a child's mental health can also influence maternal mental health. For example, Ahmadzadeh et al. (2019) used 305 adoptive families to explore how child mental health can influence adoptive parents' mental health, thus minimising genetic contributions to transmission. They observed that child anxiety symptoms at the age of 7 years positively predicted maternal anxiety symptoms at the child's age of 8 years. The suggestion is that family members are not passive recipients of the environment but receive and react to environmental stimuli in life. This thesis only evaluated how maternal psychological distress in early childhood influences the child's mental health during adolescence. It did not examine how the mother's and child's mental health interact during the time gap between 9-months and 14-years of age. Additionally, this thesis only controlled the child's baseline mental health (3 and 14 years old), it does not control the child-to-mother transmission. Focusing on a shorter time gap and examining how mother and child mental health influence each other could provide more insight into the mental health transmissions within the family, which is worth considering for future research.

The current thesis treated paternal mental health as a confounder instead of the independent variable. This measure has advantages over previous studies that explore maternal mental health's influence on child mental health because these studies usually ignore paternal mental health altogether (Letourneau et al., 2019; Loeber et al., 2009). However, other studies have shown that paternal mental health conditions (including depression and anxiety)

are associated with child internalising problems (Leinonen et al., 2003; Pearson, Evans, et al., 2013). More importantly, when evaluating family environments, it is crucial to take all family members into consideration because family interactions always involve every family member, which could have impacts on mental health. Therefore, future studies should also examine the associations between paternal mental health and child mental health by replicating this study and adding paternal mental health as an independent variable.

Concluding remarks

To conclude, this thesis explored the associations between maternal mental health at the child's early childhood and child mental health and wellbeing at late adolescence. Two mediating variables, the child self-esteem and the child attachment at child's early adolescence, were examined to see whether they mediate the effects of the transmission models. The results suggest that maternal psychological distress in early childhood is associated with child psychological distress, internalizing and externalizing problems, and reduced psychological well-being in late adolescence. Child self-esteem partially mediates these transmission processes, but this mediation becomes non-significant when considering child mental health in early adolescence. Additionally, maternal emotional stability and anxiety in early childhood are associated with child depression and anxiety in late adolescence, with these effects diminishing with additional adjustments. Child attachment at 14 years also partially mediates the transmission. Through these findings, this thesis has advanced our understanding of the intergenerational transmission of mental health. However, this thesis is not immune from limitations, including lack of indication for some variable names, small effect size, and lack of representation on minority ethnic groups. Future studies could expand on this work by looking beyond late adolescence, exploring transdiagnostic transmission, and paternal mental health's impact on child mental health.

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