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Parental bonding: Validity, stability and predictor of mental and physical health during pregnancy

Delicia Dorothy Pereira
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**Parental bonding: Validity, stability and predictor of
mental and physical health during pregnancy**

This thesis is presented in partial fulfilment of the degree of
Master of Science (Human Biology)

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School of Medical and Health Sciences

2019

Abstract

Background:

Parental bonding during childhood is known to have a significant impact on an individual's life-long health. The influence of early parent-child relationships may be particularly strong in mothers who are pregnant with their first child. In this study, these emotional bonds were explored using the Parental Bonding Instrument (PBI), a retrospective and quantitative measure of parental bonding. The PBI has not been validated in a pregnant population, nor has its consistency been examined across the birth of a child. Therefore, this study: i) validates the factor structure of the PBI for the first time in an Australian population of pregnant first-time mothers; ii) examines the stability of the PBI across the birth of their child; and iii) investigates the impact parental bonding has on a mother's mental and physical health during pregnancy.

Methods:

The data for this study was originally collected as part of a larger study of 660 pregnant first-time mothers. The PBI factor structure was examined using exploratory factor analysis. Correlations between PBI factor scores and childhood socio-economic status and stressful life events experienced before 16 years of age, were assessed to further validate the PBI. To test the stability of the PBI, the consistency of participants' recalled parental bonding before and after the birth of their first child was assessed. The PBI was used to further determine whether any changes in recollections of parental bonding were associated with stress during pregnancy, birth complications, or symptoms of depression. The relationship between recollections of parental bonding and mental and physical health outcomes, including social support and stress experienced during pregnancy, risk of depressive symptoms, the participant's age at baby's birth, pre-pregnancy body mass index, and smoking during pregnancy were all examined.

Results:

This validation of the PBI established three factors: parental *Care*, *Overprotection* and *Autonomy*. Greater parental *Care* and independence was apparent in the higher socio-economic status childhood environments. Lower parental *Care* and a greater restriction of *Autonomy* was reported by women who experienced more childhood psychosocial stress. There were strong correlations between prenatal and postnatal parental factor scores and no statistically significant differences between these scores demonstrating high levels of reliability, validity and consistency. The exception to this was women who experienced a more challenging

beginning to motherhood (e.g., foetal distress, baby feeding method at discharge, postnatal depression) recalling a more positive relationship with their mother in the postnatal PBI. Maternal *Care* was found to be the most significant predictor of participant mental health during pregnancy as it was identified in a number of outcomes.

Conclusion:

This thesis demonstrates that parental bonding during childhood is an important contributor to maternal health during pregnancy for first-time mothers. These results identify the PBI as a valuable measure in clinical and research settings for investigating the impact a pregnant woman's early developmental environment has on her life-course. Clinically, these findings highlight the need to identify women who may require additional support services in an effort to prevent intergenerational risk factors and optimise maternal and child health.

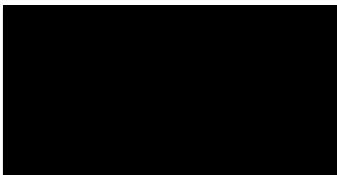
Declaration

I certify that this thesis does not, to the best of my knowledge and belief:

- I. Incorporate without acknowledgement any material previously submitted for a degree or diploma in any institution of higher education;
- II. Contain any material previously published or written by another person except where due reference is made in the text of this thesis; or
- III. Contain any defamatory material.
- IV. Contain any data that has not been collected in a manner consistent with ethics approval.

The Ethics Committee may refer any incidents involving requests for ethics approval after data collection to the relevant Faculty for action.

Signed:



Date:

18/12/2018

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To my dearest son, Warren, I dedicate this thesis to you. Thank you for your love and support.

In loving memory of my beloved partner, Trevor, my motivation and inspiration to complete this thesis and to achieve my goals. Thank you for your unwavering love, your encouragement, support, and belief in me, which is with me always.

Statement of Contribution of Others

The Statements of Contribution of Others for the contribution to the conception and design of the projects, analysis and interpretation of research data, and drafting or revising significant parts of the work of chapters 4, 5, and 6 are attached in the Appendices section.

List of Publications

1) Prenatal administration of the Parental Bonding Instrument in a sample of first-time mothers: Factor structure and correlates of childhood and adult environments

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2) The consistency of recalled parental bonding across the birth of a child in a sample of first-time mothers: A longitudinal study

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3) Parental Bonding Instrument: the early social environment predicts the mother's mental and physical health during pregnancy

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Manuscript in Preparation

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1. Introduction

Pregnancy and the birth of a first child are times of great excitement and trepidation for many first-time mothers. This is the time that many first-time mothers' view of the world changes and also when mental and physical health can be challenged (Modh, Lundgren, & Bergbom, 2011). Some new and expectant mothers turn to their parents or recollections of how they were parented as a source of guidance and support during this new life phase (Modh et al., 2011). Early parent-child relationships have a profound influence on the individual that lasts a life time (Bowlby, 1969). As a result, early relationships with parents (or caregivers) are crucial throughout development to adulthood, with lasting influences on health and emotional wellbeing (Ainsworth, 1985). In attachment theory, Bowlby (1969) asserts that children benefit when they come from a secure base of loving caregivers that support them to develop into healthy and well-adjusted adults. The alternative, a relationship built from an insecure base, has been more commonly associated with poorer mental and physical health outcomes (Bowlby, 1988).

The importance of the bond in a parent-child relationship has generally been recognised in many areas of research, however, the bond itself has limited definition (Bowlby, 1969; Parker, Tupling, & Brown, 1979). To measure parent-child bonding the Parental Bonding Instrument (PBI) was developed (Parker et al., 1979). In this study, the PBI will be used to examine first-time mothers' recollections of the bond they shared with each of their parents, whether these recollections change after the birth of their first child, and to explore the impact parental bonding has on health during pregnancy.

The PBI has been extensively used for quantifying parent-child relationships. Numerous studies have demonstrated that the PBI has wide application and has been successfully used across diverse cultures. The PBI factor structure has been studied and debated extensively (Lizardi & Klein, 2002; Terra et al., 2009; Tsaousis, Mascha, & Giovazolias, 2012). Although the PBI has been used with pregnant populations before (Kitamura, Shima, Sugawara, & Toda, 1993; Kitamura, Sugawara, Shima, & Toda, 1998a; Kitamura, Toda, Shima, Sugawara, & Sugawara, 1998b; Mahedy et al., 2014; Senior, Barnes, Emberson, & Golding, 2005), potential differences in its factor structure, stability before and after childbirth, and the impact parental bonding has on health during pregnancy have received little attention. Therefore, this thesis will address these research gaps in a series of manuscripts for publication. This knowledge will

add to our understanding of the reliability, validity, and stability of the PBI as a valuable measure for research. In this way, it can measure the impact a pregnant woman's early developmental environment has on her life-course. This will contribute to a better understanding of the life-long and intergenerational risk factors for new mothers, and the impact early life experiences can have on health during pregnancy.

2. Literature Review

A new mother's early social environment can have profound consequences for her subsequent development and her life-long relationships (Ainsworth, 1985; Bowlby, 1969). The bond between a parent and a child is a quintessentially human characteristic, however, the diversity of this relationship means it is rarely measured or defined (Parker et al., 1979). The PBI measures parent-child bonding but does not measure parent-child attachment relationships (Parker et al., 1979). The concepts of parent-child bonding and attachment relationships are similar but not the same. Bonding, in a social context, is the process of forming an attachment or close relationship (e.g., between mother and infant) that enables individuals to care for one another (VandenBos, 2007). A secure attachment relationship between a child and parent (or caregiver) is a deep emotional bond that involves a strong desire to be in close proximity to a loved one, and distress when separated from them (Ainsworth, 1989; Bowlby, 1980). In this study, the PBI will be used as a proxy to measure first time mothers' childhood attachment relationships with their parents.

2.1 Attachment theory

Attachment theory is a conceptual framework that applies a behavioural approach to understand personality development and psychopathology (Ainsworth, 1985; Bowlby, 1969; Bretherton, 1992). It was jointly developed by two eminent psychologists, John Bowlby and Mary Ainsworth (Bretherton, 1992). Attachment theory highlights the negative effects of separation, loss and maternal deprivation during the early and formative years of life (Bowlby, 1982). From its inception, attachment theory has been inter-disciplinary as it has drawn from several scientific disciplines, including developmental, social and personality psychology (Ainsworth, 1985; Bowlby, 1969). As a result, this ethologically oriented theory has generated a large amount of research that has, in turn, extended and validated this approach (e.g., Ainsworth & Bowlby, 1991; Bretherton, 1992; Cassidy, 2016).

The underlying principle of attachment theory is that children need an affectionate and continuous relationship with a mother figure, or caregiver, in which they feel unconditionally loved (Bowlby, 1988). This provides a basis for children to develop into secure, self-assured adults (Bowlby, 1988). A lack of a nurturing relationship during infancy and childhood may lead these individuals to be socially and emotionally disadvantaged for life (Bowlby, 1969). These insecurely attached individuals may be at increased risk of adverse outcomes after

parental separations and other major life events in childhood. Furthermore, these individuals are likely to have difficulties interacting with other people, which may lead to the development of behavioural and mental health issues throughout life (Ainsworth, 1985; Bowlby, 1969).

Some children have parents that are not affectionate (affectionless) and not nurturing. Bowlby found that parents who are affectionless have invariably experienced their own parents as being cold and rejecting (Ainsworth, 1985; Bowlby, 1969). Consequently, early experiences with these affectionless parents have influenced their relationship with their own children (Ainsworth, 1985; Bowlby, 1969; Mahedy et al., 2014). Many studies have supported the theory that infant-parent attachment styles can be transmitted from one generation to another (e.g., Ainsworth, 1989; Coall, Dickins, & Nettle, 2012; Mahedy et al., 2014). As a result, this intergenerational transmission of attachment reflects the quality of the infant's relationship (nurturing or affectionless) with his/her parents and has consequences for the development of subsequent generations (Bretherton, 1990; Mahedy et al., 2014).

2.1.1 Attachment styles

Attachment styles affect how well an individual's social relationships progress throughout life (Mikulincer, Shaver, & Pereg, 2003). The type of attachment impacts how an individual reacts to situations around him/her (Mikulincer et al., 2003). Ainsworth, Blehar, Waters, and Wall's (1978) ground-breaking study investigated infants' attachment to their mother figures and focused on how infants' behaviours are patterned. It was named the 'Strange Situation' because all the scenarios around attachment behaviour in the study were concerning unfamiliar situations (Ainsworth et al., 1978). This study is widely used and considered to be seminal in assessing attachment (Zeanah & Smyke, 2008).

The Strange Situation study uncovered three types of attachment styles of children and adults: secure attachment, insecure ambivalent attachment and insecure avoidant attachment (Ainsworth et al., 1978). The study showed that children in the secure attachment group used their mothers as a secure base from which to explore the world. Children in the insecure ambivalent attachment group, however, tended to display signs of anxiety during pre-separation and were intensely distressed when separated from their mothers (Ainsworth et al., 1978). During reunion, these children were ambivalent towards their mother (wanting to be physically close while resisting contact or interaction). For the insecure avoidant group

children, although they rarely cried during separation, during reunion, they avoided or ignored their mother altogether (Ainsworth et al., 1978).

In addition to the Strange Situation study, research has subsequently suggested that there is a fourth, insecure disorganised-disoriented infant attachment category (Main, 1996). These infants display odd, disorganised, conflicted behaviours in the presence of their parents, such as, freezing with a trancelike expression or fearful behaviours (Lyons-Ruth & Jacobvitz, 2008; Main, 1996). Children with these disorganised behaviours show the greatest propensity for maladaptive outcomes in young adulthood (Lyons-Ruth & Jacobvitz, 2008; Main, 1996).

2.1.2 Internal Working Models

A child's early experiences of attachment relationships with his/her primary caregiver occur at the time when the child is progressively building up his/her own "internal world" (Bowlby, 1969, p.7). This is when the child constructs "working models" (p.10) for understanding the social world around him/her, how the child and significant persons around him/her are expected to behave, and how they relate to other people socially (Bowlby, 1969). It is from within the framework of these internal working models that prejudices subsequently arise regarding the child's perception of the social world around him/her (Bowlby, 1969; Bretherton, 1990; Bretherton & Munholland, 2008).

The concept of the internal working model is fundamental to attachment theory as it relates to both children and adults (Bowlby, 1969; Pietromonaco & Barrett, 2000). Internal working models stem from the bonds that individuals build to form close emotional relationships for health and survival. These emotional bonds extend into the individual's belief about self and interpretation of the world around him/her (Bretherton & Munholland, 2008; Pietromonaco & Barrett, 2000). The focal point in this model is that in early childhood experiences there are differences in the quality of attachments with caregivers (Ainsworth et al., 1978). These experiences are centred predominantly on matters relating to distress, separation, and reunion (Bowlby, 1980). Once these internal working models form in the early years of life, they last a lifetime. Moreover, these internal working models invariably become triggered when the individual experiences a major life event (Bowlby, 1988; Bretherton & Munholland, 2008) such as the birth of their first child. Individuals who experienced a secure base during their early years, display many healthy socio-emotional processes, compared to insecure infants who are more likely to be troubled individuals in adult life (Ainsworth, 1989; Bowlby, 1988;

Johnson, Dweck, & Chen, 2007). In attachment theory, the two key constructs that play pivotal roles during the lifetime of an individual are: 1) the secure base and 2) the internal working model's principles (Bowlby, 1969). Thus, attachment theory offers a comprehensive perspective for identifying close relationship processes, for example, parent-child relationships; and for examining the impact these relationships have throughout the person's/individual's lifespan (Pietromonaco & Barrett, 2000).

2.2 Life History Theory – an Evolutionary Perspective

In attachment theory, Bowlby (1969) argues that from an evolutionary perspective, attachment is adaptive as it increases the infant's chances of survival. Infants display innate reflexes and adaptive tendencies that demonstrate proximity-seeking behaviours (e.g., smiling, vocalising or crying) that ultimately create a bond with their caregiver and increase the probability of survival (Ainsworth, 1969; Bowlby, 1969; Hrdy, 1999). Hence, building a bond safeguards the infant from danger, such as an attack by a predator, trusting that the caregiver will likely be in close proximity to the infant, and therefore, protect it from danger (Bowlby, 1969; Simpson & Belsky, 2008).

Life history theory, a branch of evolutionary theory, is dedicated to the study of life cycles which includes the survival, growth, development and reproduction of individuals (Chisholm, 1996; Coall et al., 2012). The child's early social environment has a strong influence on his/her internal working model, and thus, the behaviour of an individual (Ainsworth, 1985; Belsky, Steinberg, & Draper, 1991; Bowlby, 1969). Therefore, from an evolutionary perspective, individuals' early experiences of their social environment will influence their growth, development and reproduction, and ultimately, the timing of their life cycle (Chisholm, 1996, 1999; Coall et al., 2012; Hrdy, 1999).

One of the key environmental triggers identified in life history theory is the challenging environments associated with increased local mortality rates (e.g., death or illness of family members) that affect parents' abilities to be attentive and responsive to the needs of their children (Belsky, 1997; Chisholm, 1996). Poor maternal health outcomes and subsequent poor child health outcomes could be associated with individuals living in challenging early conditions, such as low individual- and area-level socio-economic status environments (Coall et al., 2012; Omar et al., 2010). This in turn, is known to contribute to an insecure parent-child attachment relationship (Belsky, Houts, & Fearon, 2010). In an iterative cycle across

generations, teenage pregnancies have often been associated with psychosocial stress through insecure parent-child attachment relationships (e.g., Coall et al., 2012). For example, mothers who experienced early childhood stress in the form of abuse have been shown to have poorer mother-infant interactions which may perpetuate poor health outcomes across generations (Buist, 1998). In this study, a life-history theory framework will be applied in conceptualising the impact of the early social environment on development and health throughout an individual's lifespan.

2.3 Parental Bonding Instrument

The Parental Bonding Instrument (PBI) is a self-administered, self-rated, 25-item questionnaire. It is a retrospective measure of an individual's bonding with each of his/her parents before the age of sixteen (Parker et al., 1979). As a means of quantifying parental behaviours and perceived attitudes, the PBI defines the extent of, or lack of, parental involvement, as recalled by participants (Parker et al., 1979). The basis of Parker et al.'s study was to create scales that were intended to be brief, reliable and valid measures.

2.3.1 Factor Structure of the Parental Bonding Instrument

An exploratory factor analysis was carried out by Parker et al. (1979) on the PBI with no limitation set on the number of factors to be extracted. The results of the exploratory factor analysis demonstrated that parent-child bonding could be represented by two factors: *Care* and *Overprotection* to assist the study of "optimal and distorted parental bonding" (Parker et al., 1979 , p. 9). This research by Parker et al. (1979) on optimal and distorted parental bonding was equivalent to the concepts of Bowlby's attachment theory (Bowlby, 1969), as well as Ainsworth et al.'s (1978) ground-breaking study, the Strange Situation, and Main's (1996) extension to the Strange Situation.

These parental styles of *Care* ('affection') and *Overprotection* ('psychological control') were further divided into four categories of child-rearing styles where "optimal parenting" was considered as high *Care* and low *Overprotection*; "affectionate constraint" was high *Care* and high *Overprotection*; "neglectful parenting" as low *Care* and low *Overprotection*; and "affectionless control" was deemed to be low *Care* and high *Overprotection* (Parker et al., 1979 , p. 8). The findings of Parker et al.'s study suggest that mothers were considerably more caring although a little more overprotective (controlling) compared to fathers, and these findings were not influenced by the gender of the child.

The underlying structure of the PBI continues to be debated in research (e.g., Lizardi & Klein, 2002; Murphy, Brewin, & Silka, 1997). Subsequent to identifying the two factors of parental *Care* and *Overprotection* in Parker et al.'s original PBI analysis, several researchers have suggested a three or four PBI factor structure, with many researchers claiming that a three-factor structure provided an improved fit to the data (e.g., Cox, Enns & Clara 2000; Kendler, 1996; Lizardi & Klein, 2002; Narita et al., 2000; Terra et al., 2009). Across studies, the *Care* factor in Parker et al.'s (1979) original PBI was identified as a clear factor with minor variations (Tsaousis et al., 2012). Conversely, using the three-factor structure, the *Overprotection* factor has not been clearly replicated in subsequent studies (Terra et al., 2009; Tsaousis et al., 2012). Instead of the *Overprotection* factor, two separate factors are consistently recognised (Terra et al., 2009; Tsaousis et al., 2012), although the naming of these factors varies across the studies.

2.3.2 Parental Bonding Instrument - The Three-Factor Models

PBI studies with different populations, detailed in later sections of this study, have identified different factor structures. Appendices 9.1 and 9.2 identify the items in the original PBI (Parker et al., 1979). These studies have obtained structures of two, three and four factors. Of the studies that identified three factors (e.g., Cox et al., 2000; Lizardi & Klein, 2002; Murphy et al., 1997), the Kendler (1996) study consistently demonstrated the best fit to the data. The Kendler (1996) model used 16 of the original 25 PBI items to generate three factors, namely: parental warmth (item numbers 1, 4, 5, 11, 12, 17, and 18); parental protectiveness (item numbers 8, 9, 13, 19, and 23); and parental authoritarianism (item numbers 7, 15, 21, and 25). The Kendler (1996) study population consisted of parents and adult twins pairs. Items 2, 3, 6, 10, 14, 16, 20, 22, and 24 were eliminated from the study as they were deemed inappropriate for the study and did not fit the three-factor model (Kendler, 1996).

A study consisting of 583 undergraduate students in America and 236 high school students in the United Kingdom using the original PBI showed that a three-factor structure suited their study population (Murphy et al., 1997). That study used principal component analysis to define the three factors; *Care* (items 1, 2, 4, 5, 6, 11, 12, 14, 16, 17, 18, and 24); denial of psychological autonomy factor (item numbers 8, 9, 13, 19, 20, and 23); and encouragement of behavioural freedom factor (item numbers 3, 7, 15, 21, 22, and 25).

In the Terra et al. (2009) study of 257 adult females from a clinical Brazilian population, confirmatory factor analysis was used to analyse the results of the PBI for model fit against

five previously identified different factor structures. Terra et al. (2009) found that the three-factor structures were more satisfactory, with the Kendler (1996) model providing the best fit to the data.

2.3.3 Reliability, Validity and Stability of the Parental Bonding Instrument

Reliability reflects the accuracy and consistency of the PBI, and validity defines the extent to which it is accurately measured (Heale & Twycross, 2015). The original 25-item PBI demonstrated an overall good level of reliability and validity for test-retest reliability, split-half reliability, and inter-rater reliability (Parker et al., 1979). For the concurrent validity, the inter-rater scores that were obtained after the two raters' interview with the participants, were well correlated with the scores of *Care* and *Overprotection* determined by the scales. The results of the concurrent validity established the soundness of the PBI as a measurement tool with good psychometric properties. Lastly, the intercorrelation between the scores on the *Care* and *Overprotection* scales in the original PBI suggested that the scores for these two dimensions were related to each other, which was expected for this measurement instrument (Parker et al., 1979).

Stability is the consistency of the results from the PBI using repeated testing (Heale & Twycross, 2015). There is support in the literature for the stability of the PBI over time (e.g., Murphy, Wickramaratne, & Weissman, 2010; Wilhelm, Niven, Parker, & Hadzi-Pavlovic, 2004). In a three-generation family study of depression, 134 participants were asked to complete the PBI four times across a period of 20 years (Murphy et al., 2010). Their conclusions suggested that the PBI is a suitable assessment tool over time for assessing parental bonding in those at risk of depressive disorders (Murphy et al., 2010). Similarly, a longitudinal study assessed the long-term stability of the PBI by measuring it in four waves of a non-clinical cohort of 170 participants between 1978 and 1998 (Wilhelm et al., 2004). Variations in the PBI results were identified over time because of gender, diagnosis of lifetime major depression, neuroticism and other major life events. The results indicated that mood state and life experience influences were found to have little impact on the stability of the PBI and concluded that the PBI has long-term stability and is a valid measure over extended periods of time (Wilhelm et al., 2004).

The connection between parents adverse child-rearing styles and the incidence of mood disorders in adulthood has been researched in different countries and from different cultural

backgrounds (Heider et al., 2008; Tsaousis et al., 2012). According to numerous studies, neither mood state nor the cultural background of the individual influenced the reliability and validity of the PBI (e.g., Gotlib, Mount, Cordy, & Whiffen, 1988; Heider, Matschinger, Bernert, Alonso, & Angermeyer, 2006; Tsaousis et al., 2012).

There is evidence that the PBI has good psychometric properties with demonstrated high internal consistency, good retest reliability, validity and stability (Cox et al., 2000; Kapci & Kucuker, 2006; Murphy et al., 2010; Parker et al., 1979). The PBI is a useful tool to research attachment related variables and psychopathology in individuals (Enns, Cox, & Clara, 2002; Parker et al., 1979). For example, in a study of depressed participants it was demonstrated that the PBI was not influenced considerably by depressive mood fluctuations (Gotlib et al., 1988). In the American National Comorbidity Survey ($N = 5877$) on parental bonding and adult psychopathology, participants with adverse parenting experiences were associated with 13 common mental health disorders in adulthood (Enns et al., 2002). The development of the PBI was thought to have greatly contributed to the screening for adult psychopathology resulting from dysfunctional parenting (Cox et al., 2000).

2.3.4 The Parental Bonding Instrument and Mental and Physical Health

Dysfunctional parent-child relationships have been associated with mental and physical ill-health throughout an individual's life (Bowlby, 1969). For example, the PBI was used to investigate postpartum depression in 201 women 3 days after they gave birth (Gotlib et al., 1988). Out of these 201 women, 25 women were classified as depressed and 176 women were classified as non-depressed. Of the non-depressed women, 25 were matched with respect to age, marital status and number of children to the 25 depressed women. After the initial assessment, these women were contacted again between 2 and 4 years later. The results suggest that the depressed women reported experiencing more negative parent-child relationships compared to non-depressed individuals (Gotlib et al., 1988).

In a sample of 5877 non-institutionalised participants from the American National Comorbidity Study, the connection between early parenting experiences and 13 standard mental health disorders were examined (Enns et al., 2002). Adverse parenting experiences, especially a lack of *Care*, were observed in a variety of adult psychopathologies (Enns et al., 2002). Moreover, this influence of parenting was likely to have consequences for mood disorders in subsequent generations (Mahedy et al., 2014).

Using data from the Avon Longitudinal Study of Parents and Children (ALSPAC) study on recollections of childhood experiences of being parented, 10,405 pregnant mothers completed the PBI during their antenatal period (Mahedy et al., 2014). Recollections of a lack of maternal *Care* during these mothers' childhood was associated with an increased odds (14%) of their own children suffering depression by 18 years of age and implications of an increased likelihood of an intergenerational transmission of suboptimal caregiving (Mahedy et al., 2014). Therefore, there is compelling evidence that dysfunctional parent-child relationships, particularly those with a lack of *Care*, are associated with poor mental health outcomes in later life and across generations.

The PBI has been used to test the association between distorted parental bonding and psychiatric illnesses (e.g., Enns et al., 2002; Gotlib et al., 1988; Mahedy et al., 2014). The PBI has also been used worldwide to investigate the strong link between mood disorders in relation to different categories of parental bonding (e.g., Heider et al., 2006; Heider et al., 2008; Morgan, Brugha, Fryers, & Stewart-Brown, 2012) noting that low parental affection in particular has been linked with an increased risk of depression (Mahedy et al., 2014).

2.3.5 Parental Bonding Instrument used in different cultures and populations

The PBI has been used successfully across diverse cultures, for example, American (Kendler, 1996), Brazilian (Terra et al., 2009), Chinese (Liu, Li, & Fang, 2011), Greek (Tsaousis et al., 2012), Japanese (Uji, Tanaka, Shono, & Kitamura, 2006), Malaysian (Muhammad, Shamsuddin, Omar, Shah, & Mohd Amin, 2014), Persian (Behzadi & Parker, 2015) and Turkish (Kapci & Kucuker, 2006) participants. The PBI has also been used with different family groups and populations, for example, parents and adult twin pairs (Kendler, 1996), family units (Uji et al., 2006), college students (Muhammad et al., 2014), as well as pregnant populations (e.g., Kitamura et al., 1993; Kitamura et al., 1998a; Kitamura et al., 1998b; Mahedy et al., 2014; Senior et al., 2005).

The following literature details prominent known studies that have used the PBI in pregnancy populations. Kitamura et al. (1993; 1998a; 1998b) have used the same sample of pregnant women, from a large-scale survey, who were recruited when they attended the antenatal clinic in a general hospital in Kawasaki, Japan. In a study concerning affective disorders, 120 pregnant Japanese women were researched on the onset of these disorders (Kitamura et al., 1993). During their antenatal clinics, the participants were distributed a set of questionnaires

in early, middle and late pregnancy. The PBI was administered during mid-pregnancy. The results found that for the women who were at risk for these affective disorders, they had lower paternal *Care* and higher maternal *Overprotection* than the controls (Kitamura et al., 1993).

In a study of perceived rearing practices as assessed by the PBI, the participants' relationships with their parents in relation to their birth order were researched in a sample of 1145 pregnant Japanese women (Kitamura et al., 1998a). The participants reported that their parents' appeared to be less caring if they had elder sisters and if they had more brothers, in particular younger brothers, their parents appeared to be less overprotective (Kitamura et al., 1998a).

In a study on social support during pregnancy, 1329 first-trimester pregnant Japanese women were researched (Kitamura et al., 1998b). The PBI scores were used in a factor analysis to determine the participants' relationships with their providers of social support (i.e., husband, parents, friends, children and mother-in-law). The husband was regarded as the woman's main support provider and the participant's mother came a distant second (Kitamura et al., 1998b).

In a study on symptoms of maternal eating disorder during pregnancy and during the course of the participants' lifetime, 10,641 pregnant women from the ALSPAC project were researched (Senior et al., 2005). The PBI was used to determine the early experiences these women had with their parents and during childhood. The participants that had symptoms of eating disorders recalled their parents with mental health issues; problems with alcohol; both emotional and physical cruelty; they were sexually abused; and they recalled an unhappy childhood. They were also more inclined to be troubled about their shape and weight during pregnancy which was similar to those participants who experienced a low level social support during pregnancy (Senior et al., 2005).

2.4 Summary

The early familial environment is crucial for adult development and health. Accordingly, the accurate measurement and evaluation of parental bonding is essential in understanding this process. The PBI has been used to evaluate parental bonding in this study. Even though the PBI has been used in pregnant populations before, there is a gap in the literature on its factor structure in pregnant populations, the stability of the PBI across the birth of the first child, and the impact parental bonding has on health during pregnancy. The potential benefits of this study are that by examining and validating the factor structure of the PBI in a pregnant population,

this knowledge will increase understanding of the reliability, validity, and stability of the PBI. Furthermore, examining the impact that parental bonding has on health may help to identify new predictors of maternal health outcomes. Thus, this study provides information for future screening of first-time mothers at risk of mental and physical health outcomes during pregnancy; due to the increased risks associated with their early social environment, which may ultimately improve pregnancy outcomes.

2.5 Research Aims

1. To examine and validate the factor structure of the PBI in a pregnant Western Australian population of first-time mothers.
2. To establish the consistency of the PBI score across the birth of their first child.
3. To examine whether the early social environment, as assessed via the PBI, predicts the mother's mental and physical health during pregnancy.

2.6 Hypotheses

1. A three-factor structure will be the best fit for the data in the study population.
2. Recollections of childhood parental bonding will be consistent before and after the birth of a first child
3. A distorted PBI measurement will predict poorer adult mental and physical health outcomes.

3. General Methods

3.1 Procedure

The data for this study was originally collected as part of a study of pregnant first-time mothers in Perth, Western Australia (Coall, 2005). The study population was recruited from antenatal clinics within two non-teaching hospitals: Osborne Park Hospital (OPH) (public) and St John of God Hospital, Subiaco (SJOG) (private). Questionnaire packages consisting of a general questionnaire and a consent form were distributed to 1235 participants. The general questionnaire and consent form were completed by the participants at home and returned by mail in reply paid envelopes. Out of the 1235 questionnaire packages distributed, 703 questionnaires (57%) were completed and returned. The PBI (Parker et al., 1979) was included as part of the general questionnaire. Due to difficulties with comprehension of five negatively worded items in Parker et al.'s original PBI early in the study, Gamsa's (1987) modified version of the PBI was used by 660 out of the 703 participants (Coall, 2005)

After the completed questionnaires and consent forms were received, the medical records of the study participants were accessed and made identifiable to hospital staff to indicate that the individual was a study participant (Coall, 2005). In the participant's medical record, data on the mother's medical history, mental health characteristics, details of labour and delivery, and neonate's details were subsequently collected. The criteria for inclusion into the study were participants who were primiparous women and who had delivered a singleton, live baby of 37 to 42 weeks gestation (Coall, 2005).

The combined questionnaire and PBI consisted of the initial (prenatal) questionnaire and the second (postnatal) questionnaire. Out of the 660 participants who joined at the commencement of the study, a subset of 164 participants completed the postnatal questionnaire (Coall, 2005). This subset of participants were the women who were keen and volunteered to participate further in the study. The participants who had completed the prenatal and postnatal questionnaires, therefore, enabled test-retest reliability analyses to be conducted for the PBI data.

3.2 Ethics

Ethical approval for the original study was obtained from the University of Western Australia's Human Research Ethics Committee permitting the research to be conducted at OPH and SJOG

(Coall, 2005). Permission to conduct the research project at OPH was endorsed by the OPH management and for SJOG the research was approved by the SJOG Health Care Ethics Committee. Data from OPH and SJOG were pooled in the study. The participants were recruited from OPH between March 2001 and November 2003 and SJOG between July 2002 and December 2003. Ethical approval was also obtained for the postnatal questionnaire that was sent to the subset of 164 participants (Coall, 2005). The postnatal questionnaire was completed between April 2003 and December 2004. Ethical approval for this study was obtained from the Human Research Ethics Committee at Edith Cowan University for the secondary data analysis using de-identified data (application #12347).

3.3 Questionnaire

The questionnaire enquired about the participants' demographic details, some anthropometrics, a series of questions regarding objective recollections of major life events that measured early psychosocial stress (0-15 years of age), their family environment, and stress and social support during pregnancy (Coall, 2005). The questionnaire was designed to be unintrusive and straightforward to enable swift completion and reduce any unintended impact on the pregnancy. Many of these questions were forced choice responses with boxes to tick, five questions that required a numerical response and two questions that were open-ended and required a written answer (Coall, 2005). The questionnaire was presented to the participants as one questionnaire and not in discrete sections. Each section will be described separately for clarity.

3.3.1 Demographics

Child and adult socio-economic status, ethnicity and marital status were measured in this section. Childhood socio-economic status was assessed at the individual level via subjective recall where each participant rated their family on a five-point scale from '*poor*' to '*wealthy*' in comparison to other families that they knew (Coall, 2005). Childhood Socio-Economic Indexes for Areas (SEIFA) Index of Disadvantage was assessed at the area level by each participant's childhood postcode (before 8 years of age) and Adult SEIFA was assessed at the area level by the participant's current postcode. The SEIFA index focuses on the percentage of lower education attainment, low-income earners and high unemployment in an area and is developed from The Population Census of that year. The Index of Disadvantage is the most commonly used index in the Australian Bureau of Statistics (ABS) and is available from the

1986 and the 2001 Population Censuses providing a consistent measure between childhood and adult area level socio-economic status (ABS, 1990, 1998, 2004).

The current marital status of each participant was assessed, enquiring if the participant was '*married, in a de facto relationship, single (never married), separated, or divorced*'. Total combined family income was measured using a forced choice eight-point scale from '*less than \$10,000*' to '*\$70,000 or more*'. The individual level indicators were adapted from Indicators of Social and Family Functioning (Zubrick, Williams, Silburn, & Vimpani, 2000).

The ethnic and cultural background of each participant was determined by requesting the participant to respond to the question '*Which of the following best describes you?*'. The forced choice response options were '*African*', '*Asian*', '*Australian Aboriginal*', '*European (Australian/Caucasian)*', '*Pacific Islander*' or '*other*'.

3.3.2 Anthropometrics

The height of the participants was obtained from their antenatal medical record. For their weight, they were asked to self-report their usual pre-pregnancy weight. The height and weight information were used to calculate their pre-pregnancy body mass index, which was defined as weight/height^2 (kg/m^2). Body mass index is a measure of body composition and is generally considered to reflect adiposity (Michels, Greenland, & Rosner, 1998).

3.3.3 Major life events

A crucial measure of the early developmental environment in this study was the level of childhood psychosocial stress (Coall, 2005). Stressful life events were used in the study as a measure of objective environmental conditions that promote stress (Turner & Wheaton, 1995). The objective life events used in the study were adapted from Tennant & Andrews' (1976) *Life Events Inventory* (LEI). This LEI was developed in Australian populations and has been validated across gender, age and socio-economic status (Tennant & Andrews, 1976). Of the 67 items in this LEI, only those events that could be applied to the childhood environment were included and were referred to as '*major life events*' (Revill & Dodge, 1978) (see Table 1).

Table 1. The 10 major life events used in the prenatal questionnaire (adapted from Coall, 2005).

Major life event	Life events in the prenatal questionnaire?
Suffer a serious personal injury or illness and attend hospital‡	Yes
Experience the death of a close family member‡	Yes
Experience the serious injury or illness of a close family member who had to attend hospital‡	Yes
Experience the serious injury, illness or death of a close friend‡	Yes
Experience the birth or adoption of a brother or sister you found particularly stressful†	Yes
The victim of violence in or out of the home†	Yes
Experience the divorce or separation of your parents‡	Yes
Separated from someone important to you for what seemed like a long time‡	Yes
Was a close family member arrested or in jail‡	Yes
Were you sexually abused at any time†	Yes

Note: Each life event question began with ‘*When you were growing up did/were you ever...*’

‡ Adapted from Tennant and Andrews (1976).

† Not adapted from Tennant and Andrews (1976).

The participants were asked to recall their life up to 8 years of age and 9 to 15 years of age and tick ‘*Yes*’ or ‘*No*’ to each of the questions. There were 10 major life events questions for the prenatal questionnaire. Further writing space was made available for additional stressors to be listed. Each life event question began with ‘*When you were growing up did/were you ever...*’ (Coall, 2005). There were three major life events questions in the prenatal questionnaire that were not adapted from Tennant & Andrews’ (1976) LEI. These included ‘... *experience the birth or adoption of a brother or sister which you found particularly stressful?*’, ‘... *the victim of violence in or out of the home?*’ and ‘... *sexually abused at any time?*’. Participants were asked to record whether they had been sexually abused in the past. Although this was a sensitive question, it was considered an important early stressor with prevalence rates of approximately 20 percent in Australia (Fleming, 1997). There was one question in the study regarding childhood sexual abuse.

The subjective experience of a stressful event felt by an individual would be different for each individual as this experience would be dependent upon a person's unique history and context (Sarason, Johnson, & Siegel, 1978). The participants were asked to rate each event to assess their perceptions and evaluations of stressful life events (Monroe & Kelley, 1995). In addition to the objective measure of stress, the participants were asked to rate the subjective impact each life event had on them at the time it occurred. Ratings were on a five-point scale ranging from 'extremely negative' to 'no effect'. The stressful life event data was examined both as an individual event and summed to provide a total score (Coall, 2005).

3.3.4 Family environment

The structure and function of family environments are essential to understanding the childhood psychosocial context (Fonagy & Higgitt, 2000 ; Kowaleski-Jones & Dunifon, 2004). In addition to questions regarding parental divorce and separation, the participants were asked to report the number of siblings they had in their family, their birth order and their relationships with their mother and father (Coall, 2005). To establish the participant's family size, they were asked to answer the question 'how many brothers and sisters do you have in your family?' Forced response options ranged from 'none' up to 'more than four'. Each participant's birth order was determined by asking them to record 'compared to your brothers and sisters when were you born? Were you the:' with forced response options ranging from 'first born child' through to 'later than fourth born child'? (Coall, 2005)

3.3.5 Parental Bonding Instrument

To measure early family functioning, the participants' recalled their childhood relationships with each parent. The PBI was used to measure family function (Parker et al., 1979). The PBI was originally developed and validated in Australian populations (Parker *et al.*, 1979) and used internationally (Rapee, 1997). The PBI is a subjective, self-rated, 25-item questionnaire that measures participants' recollections of their parents' attitudes and behaviours before the participants were 16 years of age (Parker et al., 1979; see Appendices 9.1 and 9.2). The original validation of the PBI comprised of 12 *Care* items and 13 *Overprotection* items that assessed each parent separately (Parker et al., 1979). The PBI items were rated on a Likert scale ranging from 0 to 3 according to whether the statement was 'very like', 'moderately like', 'moderately unlike' or 'very unlike' the participant's childhood relationships with her mother or father. The *Care* component was inversely associated with the *Overprotection* component. High scores for the 12 *Care* questions reflected a parent who was perceived by the participant to be warm and

understanding (maximum score of 36), and low scores reflected a parent who was perceived as cold and rejecting. High scores for the 13 *Overprotection* questions suggested psychological control and preventing the development of autonomy (maximum score of 39), while low scores were perceived as allowing independence. The PBI factors and item numbers are: the *Care* factor, the items are 1, 2, 4, 5, 6, 11, 12, 14, 16, 17, 18, and 24; and the *Overprotection* factor, the items are 3, 7, 8, 9, 10, 13, 15, 19, 20, 21, 22, 23, and 25 (Parker et al., 1979).

In Coall's (2005) study, the modified version of the PBI developed by Gamsa (1987) was used instead of Parker et al.'s (1979) original PBI due to issues of comprehension with five negatively formulated questions. The modified PBI rephrased the negatively formulated questions into a positive form. In Parker et al.'s original PBI, the five negatively worded items are: item 2, *Did not help me as much as I needed*; item 8, *Did not want me to grow up*; item 14, *Did not seem to understand what I needed or wanted*; item 18, *Did not talk with me very much*; item 24, *Did not praise me*. In Gamsa's (1987) modified PBI the rephrased items are: item 2, *Helped me as much as I needed*; item 8, *Wanted me to grow up*; item 14, *Seemed to understand what I needed or wanted*; item 18, *Talked to me often*; item 24, *Praised me*. The response options for both PBI items are the same: 'very like', 'moderately like', 'moderately unlike' and 'very unlike' and rated on a Likert scale from 0 to 3. Both original and modified versions of the PBI are highly correlated (Gamsa, 1987).

3.3.6 Subjective social support during pregnancy

Observational studies demonstrate that social support influences birth outcomes even in low stress populations (Hoffman & Hatch, 1996). Participants' subjective experience of the social support they experienced during pregnancy was assessed by responses to the question '*How would you describe the level of social and emotional support you have received from your partner, family or friends throughout your pregnancy*' on a five-point forced choice scale 'very good', 'good', 'neither good nor bad', 'bad', and 'very bad' (Coall, 2005). This variable was recoded into high support ('very good' and 'good') and low support ('neither good nor bad', 'bad' and 'very bad').

3.3.7 Perceived stress during pregnancy

The measure of perceived stress during pregnancy was the 10-item modified version (Cohen & Williamson, 1988) of the Perceived Stress Scale (Cohen, Kamarck, & Mermelstein, 1983). Only 281 participants completed the Perceived Stress Scale. It was used to provide a general

measure of how participants perceived stressful events during their pregnancy. Instructions for the administration of the Perceived Stress Scale were adjusted to require participants to recall their perceptions of events during their pregnancy (Coall, 2005). The Perceived Stress Scale is a self-administered questionnaire that has been used in Australian populations (Bailey & Dua, 1999). In a review of 19 articles on the psychometric properties of the Perceived Stress Scale, the 10-item Perceived Stress Scale was found to be superior compared to the 14-item Perceived Stress Scale (Lee, 2012). The Perceived Stress Scale was reported to have adequate internal and test-retest reliability, possesses substantial construct validity (Cohen & Williamson, 1988; Cole, 1999), good internal consistency and reliability with acceptable psychometric properties and has been found to be an uncomplicated questionnaire (Lee, 2012).

3.3.8 Social support during pregnancy

Social support during pregnancy was measured via the Social Provisions Scale (Cutrona & Russell, 1987). Only 282 participants completed the Social Provisions Scale. It is a 24-item measure of an individual's satisfaction with their social support. This measure was designed to assess six social provisions (guidance, reassurance of worth, social integration, attachment, nurturance and reliable alliance). The Social Provisions Scale is a valid and reliable scale that aligns with theoretical perspectives on social support (Mancini & Blieszner, 1992) and has been used in a range of adult populations (Wills & Shinar, 2000), including Australian samples (Meager & Milgrom, 1996; Perera, 2016) and populations of pregnant women (Cosden & Cortez-Ison, 1999; Cutrona, 1984; Iapichino et al., 2016). In an Italian study, 483 pregnant women (mean age 33 years) were recruited and administered the Social Provisions Scale during a follow-up visit or when they attended their antenatal classes (Iapichino et al., 2016). Their results found the 24 item Social Provisions Scale to have a strong internal consistency (Cronbach's alpha = 0.847) and that the structure of the Social Provisions Scale was robust with good psychometric properties (Iapichino et al., 2016).

3.4 Medical records

The participants provided written informed consent to access their medical records and that of their baby after their baby was born. All relevant variables were extracted from the medical records which were accessed between May and September 2004 by Coall (2005). Data collected from the medical records and that are relevant to this thesis included the participant's antenatal clinic observations, the participant's demographics, anthropometrics, psychosocial

history, medical history, the history of labour and delivery, the neonatal history, and postnatal observations.

3.4.1 Pregnancy and medical history

The participants' history of pregnancy complications from medical records were recorded as 'Yes' or 'No' responses (which included history of hyperemesis, threatened abortion, threatened preterm labour, urinary tract infection, pre-eclampsia, induced hypertension, placenta praevia, placental abruption, other antepartum haemorrhage, premature rupture of membranes, alcohol use, smoking, hypertension, gestational diabetes, or history of pregnancy other e.g., hyperthyroidism, chest or lung infection etc.).

3.4.2 Mother's psychosocial history before and during pregnancy

The most common psychological disorder reported in maternal medical histories is depression (Carter & Kostaras, 2005). The participant's psychosocial history was examined for history of depression. The use of mental health services during pregnancy where the participant was referred to a social worker or support group during pregnancy or followed up for risk of postnatal depression was recorded as 'Yes' to receiving mental health support. If the participant did not receive any mental health support or declined the mental health services they were recorded as 'No' to receiving mental health support (Coall, 2005).

To assess symptoms of depression during pregnancy the Edinburgh Postnatal Depression Scale score was used, which was available in each participant's medical record (Coall, 2005). This 10-item self-report questionnaire was developed to detect postnatal depression. The Edinburgh Postnatal Depression Scale assessed the participant's experience of common symptoms of depression over the previous seven days (Cox, Holden, & Sagovsky, 1987). Each item was scored on a four-point scale (0-3) with a possible minimum score of 0 and a maximum score of 30. Items were in the general form '*I have felt sad or miserable*' with responses from '*Yes, most of the time*' to '*No, not at all*'. The Edinburgh Postnatal Depression Scale was validated in postnatal, non-postnatal and pregnant populations (Cox, Chapman, Murray, & Jones, 1996; Murray & Cox, 1990; Thorpe, 1993) and Australian samples (Boyce, Stubbs, & Todd, 1993; Milgrom, Ericksen, Negri, & Gemmill, 2005; Milgrom et al., 2008).

3.4.3 History of labour and delivery, neonatal history, and postnatal observations

The history of labour and delivery included data on the onset of labour, mode of delivery, and the length of each stage of labour. The onset of labour was recorded as no labour, spontaneous or induced labour. The mode of delivery was recorded and categorised as spontaneous, elective caesarean section and emergency caesarean section. The reasons for operative delivery were reduced to the four most common responses (foetal distress, failure to progress, breech and maternal choice). To summarise the health of the new born, the APGAR score (Appearance, Pulse, Grimace, Activity and Respiration; Finster & Wood, 2005) was recorded at five minutes after delivery. At discharge, the participants' method of feeding their baby was recorded which included breastmilk or difficulty feeding and the use of formula (Coall, 2005).

3.5 Statistical Analysis

To examine the research questions presented in this thesis, the Statistical Package for the Social Sciences (SPSS, version 23, IBM) was used to conduct three major analyses for the three research aims.

3.5.1. To examine and validate the factor structure of the Parental Bonding Instrument in a pregnant Western Australian population of first-time mothers.

The participants' PBI responses, and their physical, socio-demographic and psychosocial variables were entered into a Microsoft Access Database. The data was then exported into the SPSS (version 23, IBM) for analysis. An exploratory factor analysis was used in this study to examine and validate the factor structure of the PBI. The exploratory factor analysis is investigative by nature and will identify the structure and relationships between the factors and their items (De Winter & Dodou, 2012; Tabachnick & Fidell, 2013). Principal Axis Factoring was used as the extraction method so as to capture all factors that are relevant including the weaker factors (De Winter & Dodou, 2012). Varimax, an orthogonal rotation, was the method used because it maximises the variance of the loadings for each factor (Tabachnick & Fidell, 2013). Varimax was also used in Parker et al.'s original PBI analysis as the method of rotation. To verify the exploratory factor analysis results, this outcome was compared to the results from a Scree test (Cattell, 1966) and Parallel Analysis (Ledesma & Valero-Mora, 2007). The Scree test (Cattell, 1966) assesses the number of factors that can be obtained in factor analytic studies and Parallel Analysis (Ledesma & Valero-Mora, 2007) is a Monte Carlo simulation technique which is a method for determining the number of factors to retain after factor extraction from an exploratory factor analysis. Once the factors were finalised, the internal consistency of each

scale was established via Cronbach's alpha (Cronbach, 1951), a measure that defines the extent to which all the items assess the same factor and test the inter-relatedness of the items (Tavakol & Dennick, 2011). (See Appendix 9.11, Diagram: Structure of the Parental Bonding Instrument items and factors as analysed using Exploratory Factor Analysis.)

The reverse coded items (i.e., the *Care* factor) were reverse scored before the PBI items were summed to provide total factor scores. The differences in the parental factor scores were investigated using paired-samples t-tests to compare the two means of the matched parental factors (Ross & Willson, 2017). In addition to the p-value as a test of statistical significance, the effect size of the difference between the parental factors was established through Cohen's *d* (Cohen, 1988). The bivariate correlations between the participants' perceived childhood socio-economic status, the participants' age at her baby's birth and their parental factor scores were explored using Pearson's correlation coefficient to examine the strength of those associations between the two sets of variables. The differences between the group means of the participants' demographic variables (e.g., childhood SEIFA, the participants' childhood stress from 0 to 15 years, adult SEIFA, where the participants grew up, birth order, the participants' family size/number of siblings) and their parental factor scores, were all compared using a one-way between groups analysis of variance (ANOVA; significant at $p < 0.05$). Tukey's HSD (Tukey's Honest Significant Difference test) and LSD (Fisher's Least Significance Difference test) were the post-hoc comparisons tests undertaken (Williams & Abdi, 2010). The participant's marital status (single, separated or divorced group versus the married or de facto relationships groups) and the parental factor scores were evaluated using Independent Samples *t* Tests to compare the means between the two groups, and Cohen's *d* determined the effect size between the groups.

3.5.2. To establish the consistency of the Parental Bonding Instrument score across the birth of their first child.

The consistency of the participants' recollections of childhood parental bonding before and after the birth of their child was tested using paired-samples t-tests by comparing the means of the prenatal and postnatal parental factor scores (Ross & Willson, 2017). To assess whether participants' recollections remained stable or changed over time, intra-individual changes between the prenatal and postnatal parental factor scores were calculated to obtain the difference between the factor scores. As a measure of correlation, the strength of the associations between the prenatal and postnatal parental factor scores were assessed using

Pearson's correlation coefficient (Sedgwick, 2012). To further assess the reliability of the PBI scores across the birth of a first child, intraclass correlation coefficient was used to analyse the prenatal and postnatal parental factor scores as a measure of test-retest reliability reflecting the degree of correlation and agreement between the factor scores (Koo & Li, 2016). As a measure of internal consistency, Guttman split-half reliability (Guttman, 1945) was used to assess the reliability between the prenatal and postnatal parental factor scores.

Pearson's correlation coefficient was performed between the length of time (in days) between completion of the two questionnaires and the prenatal and postnatal parental factor scores. Pearson correlation was also performed between the intra-individual changes between the prenatal and postnatal parental factor scores and the prenatal and postnatal parental factor scores to investigate if there were associations between the two sets of variables. Participants were stratified based on the length of time between the two questionnaires (<365 versus ≥365 days) using paired-samples t-tests to investigate the difference between the two means. Similarly, the difference between the participants' psychosocial environments and the prenatal and postnatal parental factor scores were investigated using paired-samples t-tests after stratification of the following variables: childhood stress (no stressors/1 or more stressors); history of pregnancy complications (no/yes); history of smoking during pregnancy (no/yes), level of social support during pregnancy (high/low), onset of labour (spontaneous/induced); mode of delivery; (vaginal/Caesarean section); foetal distress (no/yes); total APGAR score at 5 minutes after delivery (<=8 versus >=9); baby feeding method at discharge (difficulty feeding, use of formula/breastmilk); referred to a social worker postnatally (no/yes); Edinburgh Postnatal Depression Scale (<12 versus ≥12); and follow up for risk of postnatal depression (no/yes). (See Appendix 9.12, Diagram: Stability of the Parental Bonding Instrument before delivery compared to measurement of Parental Bonding Instrument after childbirth and factors that may reduce this stability.)

3.5.3. To examine whether the early social environment, as assessed via the Parental Bonding Instrument, predicts the mother's mental and physical health during pregnancy.

Bivariate linear and logistic regression were the initial analyses conducted on individual maternal and paternal PBI factor scores to identify which parental factors were suitable to be included into the multivariate regression models. Only the significant PBI variables ($p \leq 0.05$) were included. Multiple linear regression was used to examine the outcomes of the continuous variables: participant's age at baby's birth, pre-pregnancy body mass index, Social Provisions

Scale and Perceived Stress Scale scores. Binary logistic regression was used to examine the outcomes of the categorical variables: Edinburgh Postnatal Depression Scale (<12 versus \geq 12), follow up for risk of postnatal depression (no/yes), level of social support during pregnancy (low/high), and history of smoking during pregnancy (not smoking/smoking). The regression models were prepared using forced entry of independent variables. (See Appendix 9.13, Diagram: The likely factors that may mediate the association between parental bonding and poor mental and physical health outcomes.)

The models were adjusted for demographic and psychosocial variables as research has revealed that environmental factors can affect parent-child bonding (Crestani, Mattana, De Moraes, & De Souza, 2013; Dahlen et al., 2015). The models were re-run multiple times, removing variables with insignificant beta (β) coefficients and confidence intervals (95% CI). The resultant significant beta (β) predictor variables were: total family income, adult SEIFA index, and marital status. The participants' birth order was found to be a significant beta (β) predictor variable for the outcome participant's age at baby's birth. Research has revealed that birth order bears an influence in family/sibling dynamics (McGuire & Shanahan, 2010; Sulloway, 2010). A sensitivity analysis was conducted by removing the outliers that exceeded the Mahalanobis distances of critical χ^2 value. However, exclusion of these cases did not significantly change the results or interpretation of the regression models and therefore, the final models with all cases included are presented.

The following chapters are not included in this version of the thesis:

Chapter 4. Prenatal administration of the Parental Bonding Instrument in a sample of first-time mothers: Factor structure and correlates of childhood and adult environments

Chapter 5. The consistency of recalled parental bonding across the birth of a child in a sample of firsttime mothers: A longitudinal study

Chapter 6. Parental Bonding Instrument: the early social environment predicts the mother's mental and physical health during pregnancy

7. General Discussion

This thesis demonstrates the importance of parental bonding during childhood by identifying associations between parental bonding and mental health in adulthood, and how these factors are likely to influence women during pregnancy. Accordingly, this study examines the factor structure and stability of the PBI and its associations with maternal mental and physical health during pregnancy. In this study, the PBI factor structure has been validated for the first time in research in an Australian population of pregnant primiparous mothers. This validation involved the investigation and establishment of three factors of parental *Care*, *Overprotection* and *Autonomy*. Correlations between the PBI and aspects of the childhood environment including childhood socio-economic status and stressful life events experienced before 16 years of age further validated the PBI. To further assess the stability of PBI factor scores, the consistency of the participants' recall of parental bonding before and after a major life event, the birth of their first child, was examined. Strong correlations emerged between prenatal and postnatal parental factor scores where there were no statistically significant differences in these scores in the full cohort. Together these findings demonstrate the PBI as obtaining an overall high level of reliability, validity and consistency across this population. Interestingly, women who experienced a more challenging beginning to motherhood (e.g., foetal distress, baby feeding method at discharge, postnatal depression) recalled a more positive relationship with their mother in the postnatal questionnaire. Finally, parental bonding, particularly maternal *Care*, was found to be the most significant predictor of participants' mental health during pregnancy. Overall, this evidence identifies the PBI as a tool that may usefully contribute to researchers' understanding of the early developmental environment as a life-long and intergenerational risk or protective factor for maternal and child health.

7.1 Parental Bonding Instrument

This is the first study to validate the PBI factor structure in a pregnant population, demonstrating that the PBI is reproducible, generalisable, and therefore, a useful clinical and research tool. Research has demonstrated the PBI as a retrospective and quantitative measure of parent-child bonding relationships, an effective measurement tool to explore emotional bonds between parents and children (Parker et al., 1979). The PBI has been researched extensively, across diverse cultures, translated into many languages and with different populations, including pregnant populations (e.g., Kitamura et al., 1993; Kitamura et al., 1998a;

Kitamura et al., 1998b; Mahedy et al., 2014; Senior et al., 2005). However, until now the PBI factor structure has never been validated in a pregnant population.

To examine the PBI factor structure, an exploratory factor analysis was undertaken. The exploratory nature of this analysis was applied to ensure that no expectations were assigned to the number of factors or items extracted. The exploratory factor analysis in this study demonstrated that parent-child bonding could be analysed using three factors: parental *Care*, *Overprotection* and *Autonomy*. This three-factor PBI structure is aligned with other PBI studies that reported a three-factor structure using exploratory factor analysis, for example, the American study of parents and adult twin pairs (Kendler, 1996) reported three factors: a *Care* factor (parental warmth) and two *Overprotection* factors (protectiveness and authoritarianism); the Australia/New Zealand study of adolescents (Cubis et al., 1989) reported three factors: a *Care* factor and two *Overprotection* factors (protection personal domain and social domain); and the Malaysian study of college students (Muhammad et al., 2014). The Malaysian study is of specific interest here because it applies the modified PBI (Gamsa, 1987) as utilised in this current study. The Malaysian PBI also reported three factors: *Care*, *Autonomy* and *Overprotection*, which correspond to the three factors in this study. Additionally, in a recent study of the PBI, the three-factor structure was confirmed using exploratory structural equation modelling (Xu, Morin, Marsh, Richards, & Jones, 2018). This study was based on responses from the British 1946 birth cohort in the Medical Research Council National Survey of Health and Development population in Britain (Xu et al., 2018). The participants were singleton babies born in one week in March 1946 in England, Scotland, and Wales and rated the PBI at 43 years of age. The results of this British study revealed three factors namely: *Care*, *Overprotection* and *Autonomy* (Xu et al., 2018) which is similar to this study. The three-factor structure of the PBI has persisted regardless of differences in cultures, populations and methodologies demonstrating that the PBI is a robust measure with good psychometric properties and applicability.

7.2 Family function and socio-economic status

The PBI self-reports and socio-demographic characteristics of the majority of the participants in this study suggest that they came from higher socio-economic status childhood households. Most of the participants experienced an optimal child rearing style of high *Care*/low *Overprotection* (Parker et al., 1979). The majority of the participants were financially stable, in long-term relationships, and began a family at a mature stage in their lives. This corresponds

to research supporting that the parenting styles the participants experienced were representative of their socio-economic status (Denny, Gavidia-Payne, Davis, Francis, & Jackson, 2014; Hoff, Laursen, & Tardif, 2002). These analyses demonstrate that the PBI is a robust measure in assessing family function and providing insight into socio-economic status.

7.3 The Parental Bonding Instrument and the early and adult psychosocial environments

A crucial aspect of the PBI evaluation involved exploring the elements of participants' childhood and associated with adult psychosocial environments. The assumption being, if the PBI is a valid measure of the early parent-child relationship, it should be associated with other aspects of the early environment more so than the adult environment. The findings generally support this assumption with childhood socio-economic status and early stress being associated with PBI factor scores whereas only marital status was related as an adult.

In higher socio-economic status childhood environments, more parental *Care* and independence was evident demonstrating an optimal child-rearing style experienced by the participants. However, lower parental *Care* and a greater restriction of *Autonomy* was reported by the participants who experienced greater childhood psychosocial stress before 16 years of age. Participants who experienced more childhood psychosocial stress (e.g., childhood abuse, parental divorce, illness, death in the family, etc. See Coall & Chisholm, 2010) in their first 16 years reported lower maternal and paternal PBI *Care* scores compared to participants who reported no stressors. A mechanism that may account for this association is that less-optimal parenting may increase childhood stress. In a study of 1276 Australian parents of young children, demographic, psychosocial, self-care and parental sleep details were collected to assess parenting behaviours due to parental functioning as a result of parental fatigue (Cooklin, Giallo, & Rose, 2012). The results revealed that higher parental fatigue was attributed to several psychosocial aspects including ineffective coping styles contributing to adverse parental practices and, therefore, parenting experiences (Cooklin et al., 2012). Alternatively, stressful childhood environments could occur as a result of lower education, income or socio-economic status which could have a causal influence on families and children (Conger, Conger, & Martin, 2010). Here, the challenging external environment may cause both poorer parenting practices and increased childhood stress. Although, this study cannot establish causal relationships, these findings indicate that the PBI is a valuable measure of parent-child bonding that does not share

a lot of variance with childhood stress and, therefore, will be a useful tool to advance research where the aim is to distinguish aspects of early developmental environment.

The only aspect of the adult environment that PBI factor scores were associated with was marital status. The participants who were single (i.e., never married, separated or divorced) recalled significantly lower levels of paternal *Care* scores during childhood compared to participants who were married or in a de facto relationship. As previously noted, participants who reported greater childhood psychosocial stress before 16 years of age also reported lower levels of parental *Care*, where early stress is a known risk factor for early marriage and divorce (Belsky, 1997; Belsky et al., 1991; Bereczkei & Csanaky, 2001). However, this finding suggests that, in addition to lower levels of parental *Care* being a known risk factor, paternal *Care* in particular may have more of an influence on the romantic relationships that daughters form (Barrett & Morman, 2012; Nielsen, 2014; Punyanunt-Carter, 2008). In a study of father-daughter dyads within the family system, 43 fathers and 43 daughters (unrelated) from various backgrounds and occupations were asked about the fathers' and daughters' perceptions of the strength of their own relationship with their respective daughter or father and the turning point of events that affected their respective relationships as the daughter grew up (Barrett & Morman, 2012). In their findings, the most meaningful experiences that created change in the closeness within their respective relationships, were being involved in the same activities together and when the daughter got married (Barrett & Morman, 2012). As the majority of participants in this study came from a high socio-economic status, it is likely that most fathers of participants in this study would be involved and supportive of their daughter's new role as a mother. However, for the small number of participants who were single in this study, further research would be beneficial to investigate the factors underlying why single, mature aged first-time mothers reported lower levels of paternal *Care* during childhood and whether this may be a causal relationship.

7.4 Consistency of recalled parental bonding across the birth of a child

Attachment has generally been recognised as a stable characteristic throughout an individual's life (Bowlby 1969). There is evidence, however, that attachment can change over time in relation to experienced life events (Gillath, Hart, Nofle, & Stockdale, 2009). In longitudinal studies, the PBI has been shown to demonstrate stable recollections of parental bonding over 20-year periods (Murphy et al., 2010; Wilhelm et al., 2004). However, the PBI's consistency has not been examined across a major life event such as the birth of a first child which may

simultaneously impact an individual's mental and physical health and their perception of how they were parented. In the current study, the PBI was found to be a consistent and stable measure across the birth of a child. The prenatal and postnatal parental factor scores were found to be strongly correlated with no statistically significant differences between factor scores in the full cohort. Moreover, similar to Parker et al. 's (1979) original research, this study demonstrates an overall good level of reliability and validity for test-retest reliability and split-half reliability. The analyses in this study demonstrate the stability, consistency and reliability of the PBI across the birth of a child adding further evidence to its value as a research and clinical tool.

7.5 Changing perceptions of parental bonding following childbirth

Participants' perceptions of parental bonding following the birth of their child was assessed to determine if recollections of parental bonding changed due to the participants' early life stressors, their birth complications, or postnatal depression. Although many experienced an uncomplicated childbirth and delivered healthy babies (APGAR scores ≥ 9), there was a subset of participants who experienced a more challenging beginning to motherhood (e.g., foetal distress, baby feeding method at discharge, postnatal depression). In their postnatal assessments, these mothers recalled more positively how they were parented by their own mothers. Maternal *Overprotection* was scored significantly lower in the postnatal assessment by those participants whose baby experienced foetal distress during labour. A significant increase in recalled maternal *Care* scores were observed for those participants who had experienced difficulties in breastfeeding. This suggests that current stressful events that may change a new mother's interaction with family members may also impact recalled parental bonding.

Changes in recalled PBI scores were also observed for mothers who experienced mental health challenges during pregnancy. Significantly higher maternal *Care* and lower maternal *Overprotection* were recalled by the small number of participants who were likely to be at risk of experiencing postnatal depression (Edinburgh Postnatal Depression Scale ≥ 12). Similarly, in the postnatal assessments of the participants who were followed up for risk of postnatal depression, significantly higher maternal *Care* scores were reported. Through major life changes, which would typically involve familial relationships, mother-daughter relationships usually remain an important aspect in this intimate dynamic (Bojczyk, Lehan, McWey, Melson, & Kaufman, 2011). The mothers in this mother-daughter relationship, would generally be more

mindful of this generational continuity (Bojczyk et al., 2011), especially with their daughter's first child. Research has demonstrated that mothers, especially mothers of first-time mothers, are an important source of social support, enhancing self-efficacy and decreasing the likelihood of postnatal depression (Dieterich et al., 2013; Elsenbruch et al., 2006; Haslam et al., 2006; Hodnett et al., 2012; Leahy-Warren, 2005; Leahy-Warren et al., 2012; Meedya et al., 2010; Negron et al., 2013; Sauls, 2002). Hence, these negative circumstances that have resulted in a challenging start to motherhood, may have impacted their recollections of parental bonding towards more positive recollections, potentially bringing mothers and daughters closer together.

Some variations in the recollection of parental bonding were associated with the time between completion of the pre and postnatal questionnaires. For the participants who completed both the prenatal and postnatal questionnaires, those participants who completed their assessment within a year of the prenatal questionnaire had higher parental *Care* scores generally, but significantly higher paternal *Care* scores in the postnatal questionnaire. Research indicates that fathers of adult daughters have a greater psychological influence than mothers when it concerns marital relationships (Barrett & Morman, 2012; Nielsen, 2014; Punyanunt-Carter, 2008). As a result, daughters that experienced a secure attachment style as children, subsequently developed a strong bond with their fathers, and would be more likely to develop a better understanding of their fathers when they became parents themselves (Barrett & Morman, 2012; Nielsen, 2014). These results are consistent with the findings of this current study where most participants experienced a reasonably optimal childhood parenting style. As a result, higher paternal *Care* scores following the birth of their child may indicate a stronger appreciation and improved relationship with their father. For the participants that completed their postnatal assessment a year after their prenatal assessment, their reported parental *Care* scores were marginally lower. This appears to be an original finding and no obvious causal mechanisms exist, however, it is suggestive that new mothers' turn their attention from their own parents to their new family unit and transition to parenthood (Belsky & Rovine, 1990; Lawrence et al., 2008; Mitnick et al., 2009).

7.6 Parental bonding and maternal mental health during pregnancy

The validity and stability of the PBI throughout pregnancy and after the birth of a first child has been established. However, the true value of this methodology is examining parental bonding as a measure of the early environment and its potential impact on subsequent maternal

mental health. Aspects of this, such as the mother's psychosocial environment during pregnancy, are in-turn recognised to influence infant health and behaviour (Coall et al., 2015). PBI parental factor scores were significant predictors of the mental health of first-time mothers' during pregnancy in this study. There were many outcomes for which maternal *Care* and/or *Overprotection* were significant predictors. Maternal *Care* was identified as the most predictive of the PBI factors, compared to the other maternal factors and paternal factors. More maternal *Care* was associated with increased social support during pregnancy and a reduced risk of postnatal depression or being identified for follow up for risk of depression by a social worker or support group. The beneficial impact of maternal *Care* demonstrated in this study appears to be consistent with previous research (Bowlby, 1988; Elsenbruch et al., 2006; Haslam et al., 2006; Leahy-Warren, 2005; Leahy-Warren et al., 2012). In this study, parental bonding is identified as an important aspect of a mother's life course that is associated with her subsequent health. In particular, maternal *Care* was the most important aspect of the early psychosocial environment that significantly predicted a broad range of maternal mental health outcomes during pregnancy.

To investigate the maternal psychosocial environment in more detail, the Social Provisions Scale (Cutrona & Russell, 1987) and the Perceived Stress Scale (Cohen et al., 1983) were completed by a subset of participants. These scales were analysed to provide a more detailed understanding of the mode of social support that was provided by their social network of family and friends during pregnancy. Higher maternal *Care* and lower *Overprotection* scores during childhood were significant predictors of the Social Provisions subscales of attachment, reassurance of worth, guidance, social integration, and the total score. There are several mechanisms through which this association may work. For example, it may be mediated by an individual's internal working model generated from a high maternal *Care* environment. In a study on recollections of parental warmth, Kelly and Dupasquier (2016) identified that greater parental warmth during the early years was associated with increased capacity to be compassionate to oneself and also to receive compassion. Therefore, it may not purely be that those with more caring parents would then have more support from their parents during pregnancy. Rather, it may be that those who had more maternal *Care* during childhood may be more open/responsive to receiving social support.

The findings for maternal stress were greatly different to those for social support. In contrast to social support, maternal PBI factor scores were not associated with the Perceived Stress

scale during pregnancy. Instead, paternal *Overprotection* was found to be a significant predictor, which is in contrast to the majority of the other outcomes that were examined. These analyses suggest that early relationships have life-long consequences on relationship quality that can impact an individual's ability to secure emotional and material resources. These factors may ultimately have intergenerational consequences for health.

The participants' age at the birth of their child was the median age of mothers in Australia (ABS, 2003a). The participants who were older reported less maternal *Care* and more restriction in independence. This finding could be due to changes in parenting styles over time (Trifan et al., 2014) or that women who experienced lower levels of maternal *Care* were likely to delay becoming parents. In the evolutionary developmental psychology literature, however, insecure attachment in parent-daughter relationships is more commonly associated with accelerated reproductive development and timing (Belsky, 1997; Belsky et al., 1991; Chisholm et al., 1993; Chisholm et al., 2005). Alternatively, a recent study on late motherhood, articulates the trend of women from high socio-economic status areas, who have completed their education and entered the labour market, to delay parenthood (Sobotka & Beaujouan, 2018). Further research would need to be conducted on women who delayed parenthood due to family conditions or as a new trend towards career women.

Parental bonding was also associated with mothers' physical health and behaviour during pregnancy. Maternal *Autonomy* was a significant, albeit weak, predictor of pre-pregnancy body mass index of participants. There was a reduced amount of variation with a high proportion of participants in the normal weight category (body mass index 18.5-24.9). As body mass index has previously been demonstrated to be associated with socio-economic status (Sanigorski et al., 2007), in this study there may be limited variability in body mass index data due to the relatively high socio-economic status of the participants. However, it must also be noted that this association may result from recall or reporting bias (Hattori & Sturm, 2013; Preston et al., 2015). For the body mass index data collected in this study, participant height was available in the medical record, however, pre-pregnancy weight was self-reported and, therefore, may be subject to bias.

In this study, there was a low percentage (7%) of women who smoked during pregnancy. The analyses on participants' psychosocial environments found that both parental *Care* scores were higher in the postnatal PBI, however paternal *Care* was significantly higher. There was no

information noted if these participants' parents were smokers. However, there is a possibility that these participants may have been exposed to either or both parents' smoking habits at a young age according to research on the intergenerational transmission of smoking (e.g., Chassin et al., 2008; Escario & Wilkinson, 2015). At the time these participants were growing up there seemed to be a greater percentage of male smokers compared to female smokers revealed in Australian Social Trends (ABS, 2000, 2003b). If the participant had a more caring relationship with her father, this occurrence may account for the finding that paternal, but not maternal, *Care* presented a significant increase in the postnatal *Care* scores. This is, however, speculative as there is no verification if these participants' fathers had smoked during their early years. Regression analyses predicted that maternal *Overprotection* was likely to influence participant smoking during pregnancy. Research on women who smoked during pregnancy found that: these women that smoked did so due to psychosocial stressors, were generally younger in age, had a lower level of education, and possessed lower socio-economic status (Ebert & Fahy, 2007). These analyses demonstrate the complexity of the factors that influence a woman's propensity to smoke during pregnancy which provides a good base for future research.

7.7 Limitations

The data source used in this study provided an excellent opportunity to investigate parental bonding in pregnancy and longitudinally. However, there are also some limitations. The homogeneity of this low risk sample is a limitation because of the low variability in parenting styles due to relatively low-risk early environments. Therefore, there is low variability in the child-rearing styles experienced, however, it does provide a sound baseline for future studies of this nature. Although the participants were recruited between 2001 and 2003, there is no obvious reason to expect variation in parental bonding and its correlates would vary between now and then.

7.8 Future Directions

This study has added to the research that identifies the PBI as a valid and stable retrospective measure of early parental bonding. Moreover, the PBI factors, particularly maternal *Care*, were associated with health outcomes during pregnancy. As a result, these findings promote this measure of the early environment for use in clinical or research settings, providing the basis for examining different aspects of the early environment. Future research will be needed to recognise more components of the mother's early environment when examining the life-long

and intergenerational risk factors for maternal and child health. Further research would be beneficial to determine the necessary support services to aid maternal and child health during pregnancy.

7.9 Conclusion

This study contributes to researchers' understanding of parental bonding during childhood using the PBI and the subsequent implications of parental bonding on health during adulthood. Although the PBI is recognised as an effective, retrospective and quantitative measure of parent-child bonding relationships (Parker et al., 1979), this empirical study of the PBI has made an important contribution to research and further expanded the mode of assessment to include the psychosocial factors of the study population. This is the first study to examine the factor structure of the PBI and validate it in a pregnant population of first-time mothers in Australia where three factors of parental *Care*, *Overprotection* and *Autonomy* were established. More parental *Care* and independence was given in the higher socio-economic status childhood environments which was representative of an optimal child-rearing style (high *Care*/low *Overprotection*; Parker et al., 1979) experienced by the participants. For the participants who experienced greater childhood psychosocial stress before 16 years of age, lower parental *Care* and a greater restriction of *Autonomy* was noted. The consistency of the participants' recall of parental bonding before and after the birth of their first child was evaluated to further assess the stability of the PBI factor structure. There was a strong correlation and no statistically significant differences in the full cohort between the prenatal and postnatal parental factor scores demonstrating an overall high level of reliability, validity and consistency; although a more positive relationship with their mother in the postnatal questionnaire was recalled by the participants who experienced a more challenging beginning to motherhood (e.g., foetal distress, baby feeding method at discharge, postnatal depression). Finally, parental bonding, especially maternal *Care*, was found to be a significant predictor for the participants' mental health during pregnancy. This research highlights and demonstrates the importance of parental bonding in the early psychosocial environment and its subsequent effects on adult mental health.

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9. Appendices

9.1 The items in the Mother's form of the original Parental Bonding Instrument (Parker et al., 1979)

MOTHER FORM

This questionnaire lists various attitudes and behaviours of parents. As you remember your MOTHER in your first 16 years would you place a tick in the most appropriate box next to each question.

	Very like	Moderately like	Moderately unlike	Very unlike
1. Spoke to me in a warm and friendly voice	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Did not help me as much as I needed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Let me do those things I liked doing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Seemed emotionally cold to me	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Appeared to understand my problems and worries	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Was affectionate to me	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Liked me to make my own decisions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Did not want me to grow up	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Tried to control everything I did	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Invaded my privacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. Enjoyed talking things over with me	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. Frequently smiled at me	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. Tended to baby me	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. Did not seem to understand what I needed or wanted	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. Let me decide things for myself	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. Made me feel I wasn't wanted	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. Could make me feel better when I was upset	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18. Did not talk with me very much	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19. Tried to make me feel dependent on her/him	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20. Felt I could not look after myself unless she/he was around	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21. Gave me as much freedom as I wanted	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22. Let me go out as often as I wanted	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
23. Was overprotective of me	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
24. Did not praise me	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
25. Let me dress in any way I pleased	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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9.2 The items in the Father's form of the original Parental Bonding Instrument (Parker et al., 1979)

FATHER FORM

This questionnaire lists various attitudes and behaviours of parents. As you remember your FATHER in your first 16 years would you place a tick in the most appropriate box next to each question.

	Very like	Moderately like	Moderately unlike	Very unlike
1. Spoke to me in a warm and friendly voice	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Did not help me as much as I needed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Let me do those things I liked doing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Seemed emotionally cold to me	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Appeared to understand my problems and worries	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Was affectionate to me	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Liked me to make my own decisions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Did not want me to grow up	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Tried to control everything I did	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Invaded my privacy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. Enjoyed talking things over with me	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. Frequently smiled at me	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. Tended to baby me	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. Did not seem to understand what I needed or wanted	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. Let me decide things for myself	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. Made me feel I wasn't wanted	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. Could make me feel better when I was upset	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18. Did not talk with me very much	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19. Tried to make me feel dependent of her/him	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20. Felt I could not look after myself unless she/he was around	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21. Gave me as much freedom as I wanted	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22. Let me go out as often as I wanted	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
23. Was overprotective of me	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
24. Did not praise me	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
25. Let me dress in any way I pleased	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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9.3 Modified Parental Bonding Instrument (Gamsa, 1987)

The modified Parental Bonding Instrument (Gamsa, 1987) rephrased the negatively formulated questions of Parker et al.'s (1979) original Parental Bonding Instrument into a positive form.

Original statement	Modified statement
2. Did not help me as much as I needed	2. Helped me as much as I needed
8. Did not want me to grow up	8. Wanted me to grow up
14. Did not seem to understand what I needed or wanted	14. Seemed to understand what I needed of wanted
18. Did not talk with me very much	18. Talked to me often
24. Did not praise me	24. Praised me

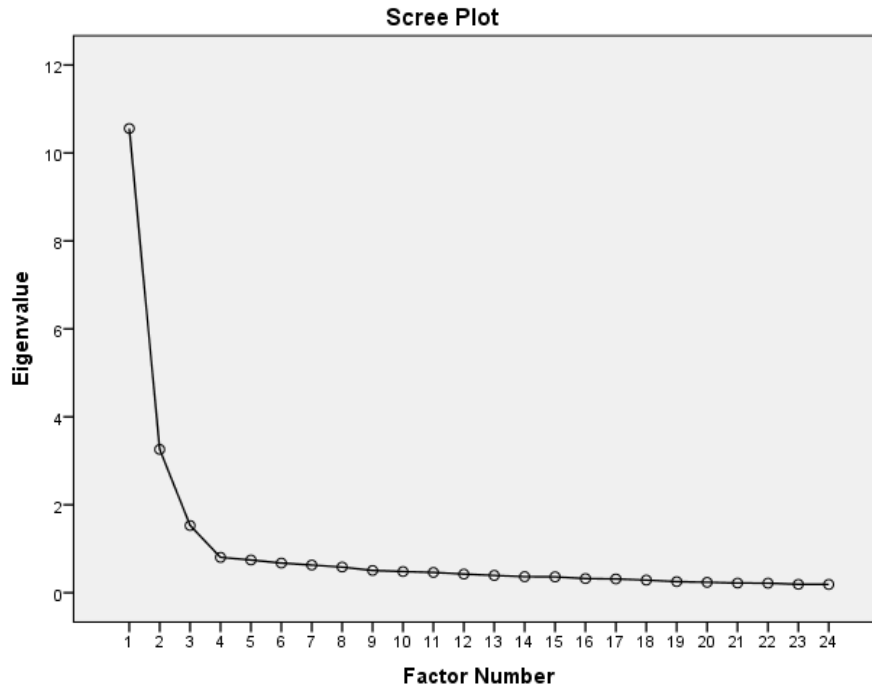
9.4 Missing Items

Parental Bonding Instrument questionnaires for participants' Mother and Father.

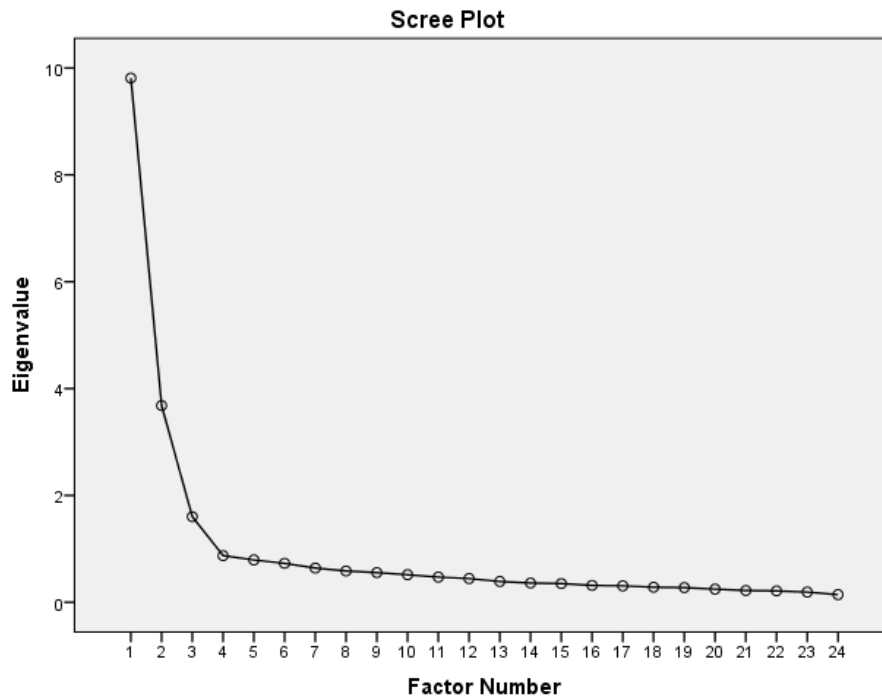
Item	Mother	Father
1	1	1
2	1	3
3	3	5
4	4	3
5	4	8
6	0	3
7	0	9
8	6	13
9	1	10
10	0	7
11	3	7
12	3	3
13	1	7
14	2	7
15	3	11
16	5	9
17	1	8
18	2	8
19	2	8
20	3	8
21	3	11
22	4	11
23	5	11
24	2	9
25	1	7
Summary:		
Not appropriate	5	25
Individuals with 1 or more missing items	36 (5.5%)	45 (6.8%)
Individuals with only 1 missing item only (excluding item 8)	28	30
Individuals with missing item 8 only	5	3
Participants with no missing data (excluding item 8)	619	590

9.5 Scree Plots

Parental Bonding Instrument questionnaire for Mother.

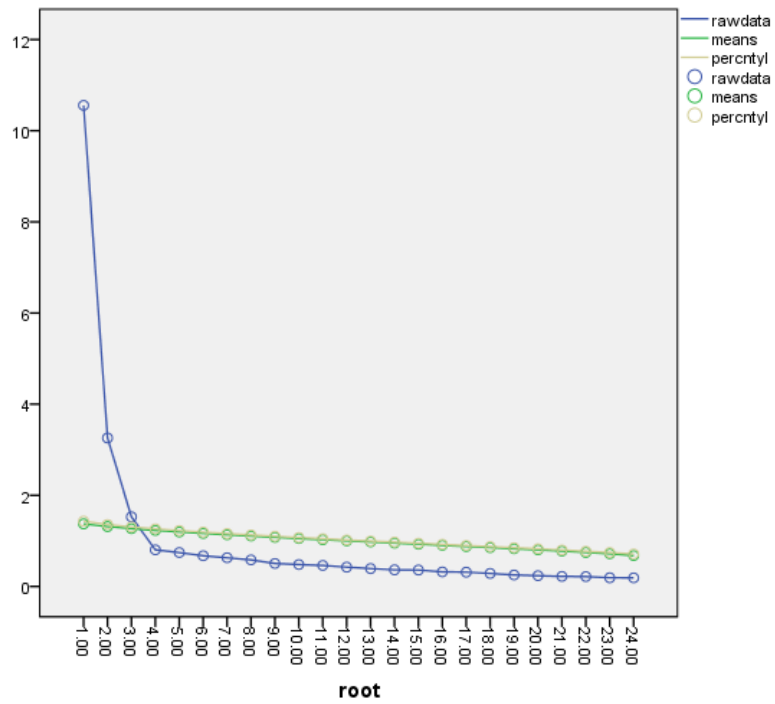


Parental Bonding Instrument questionnaire for Father.

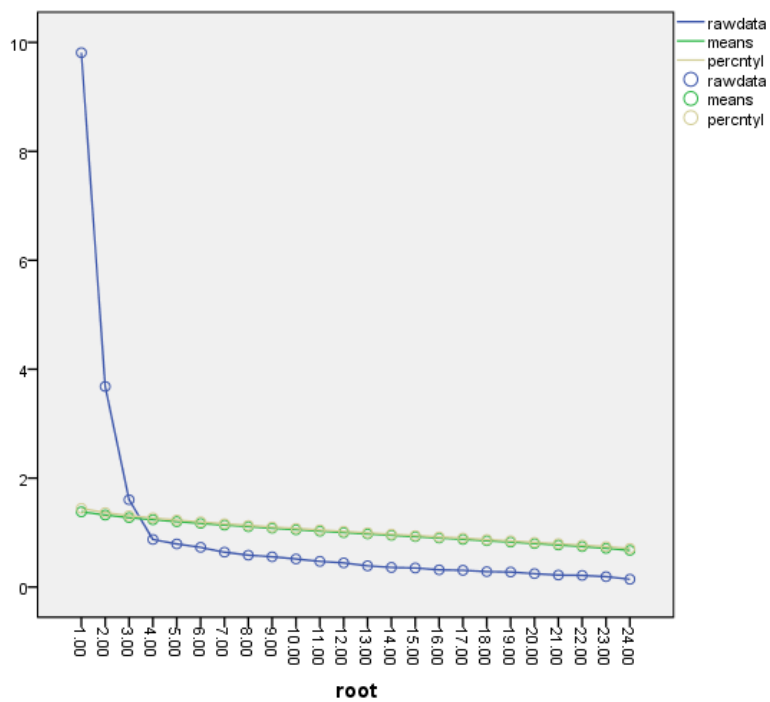


9.6 Parallel Analysis

Parental Bonding Instrument questionnaire for Mother.



Parental Bonding Instrument questionnaire for Father.



9.7 Comparison of studies

Comparison of Parker al.'s (1979) and this study's (Pereira et al., in review; chapter 4)

Parental Bonding Instrument factors and item numbers.

Study	Year conducted study	Population	Factors	Factor Names	Items	Item numbers
Parker et al., (1979)	1979	Britain / Australia	2	Care	25	1, 2, 4, 5, 6, 11, 12, 14, 16, 17, 18, 24
				Overprotection		3, 7, 8, 9, 10, 13, 15, 19, 20, 21, 22, 23, 25
Pereira et al. (in review; chapter 4)	2001-2003	Australia	3	Care	24	1, 2, 4, 5, 6, 11, 12, 14, 16, 17, 18, 24
				Overprotection		9, 10, 13, 19, 20, 23
				Autonomy		3, 7, 15, 21, 22, 25

Note. Item 8 was omitted from Pereira et al.'s study due to an insufficient factor loading.

The following appendices are not included in this version of the thesis:

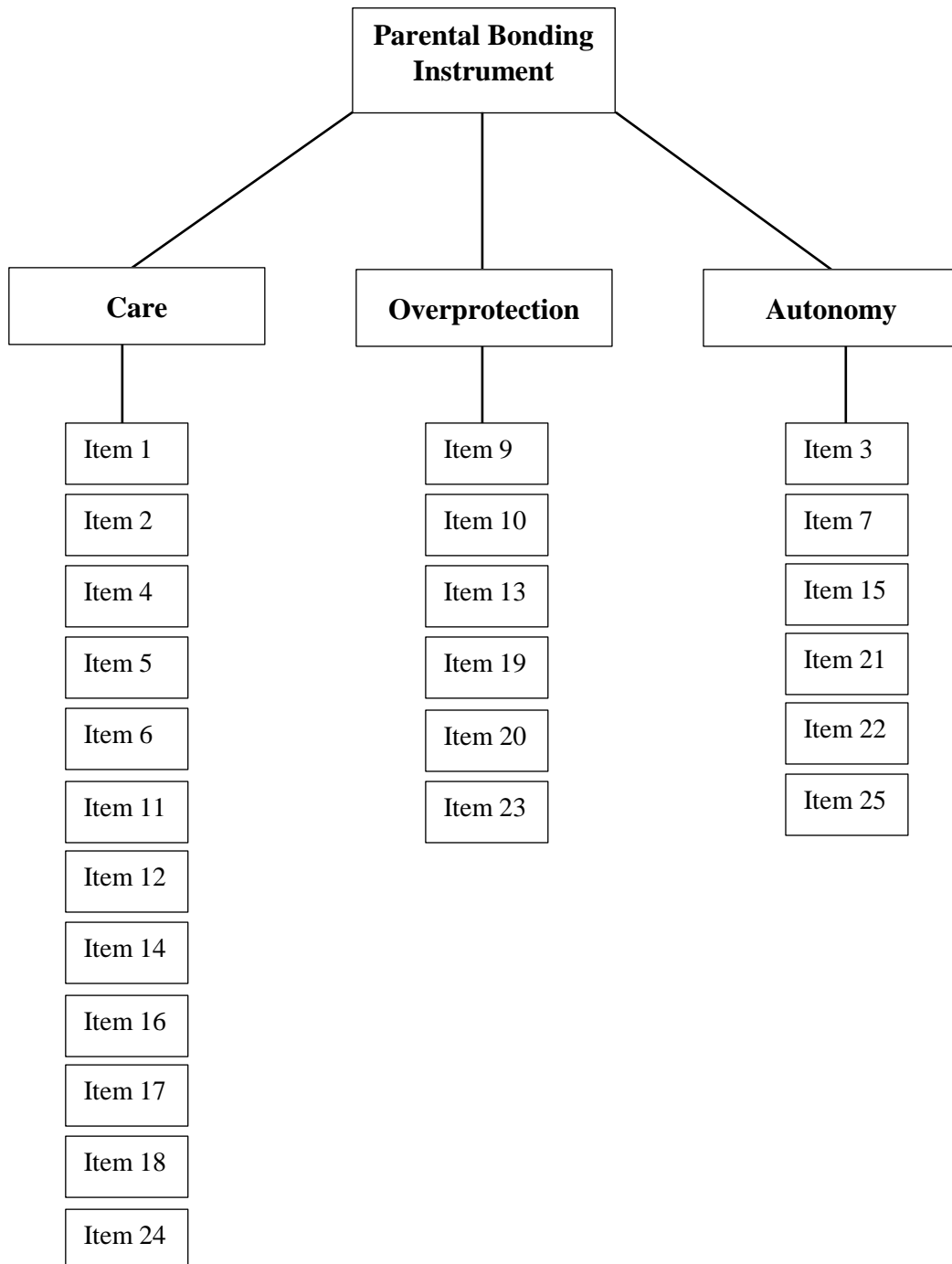
9.8 Statement of Contribution of Others for Chapter 4

9.9 Statement of Contribution of Others for Chapter 5

9.10 Statement of Contribution of Others for Chapter 6

9.11 Diagram for Chapter 4

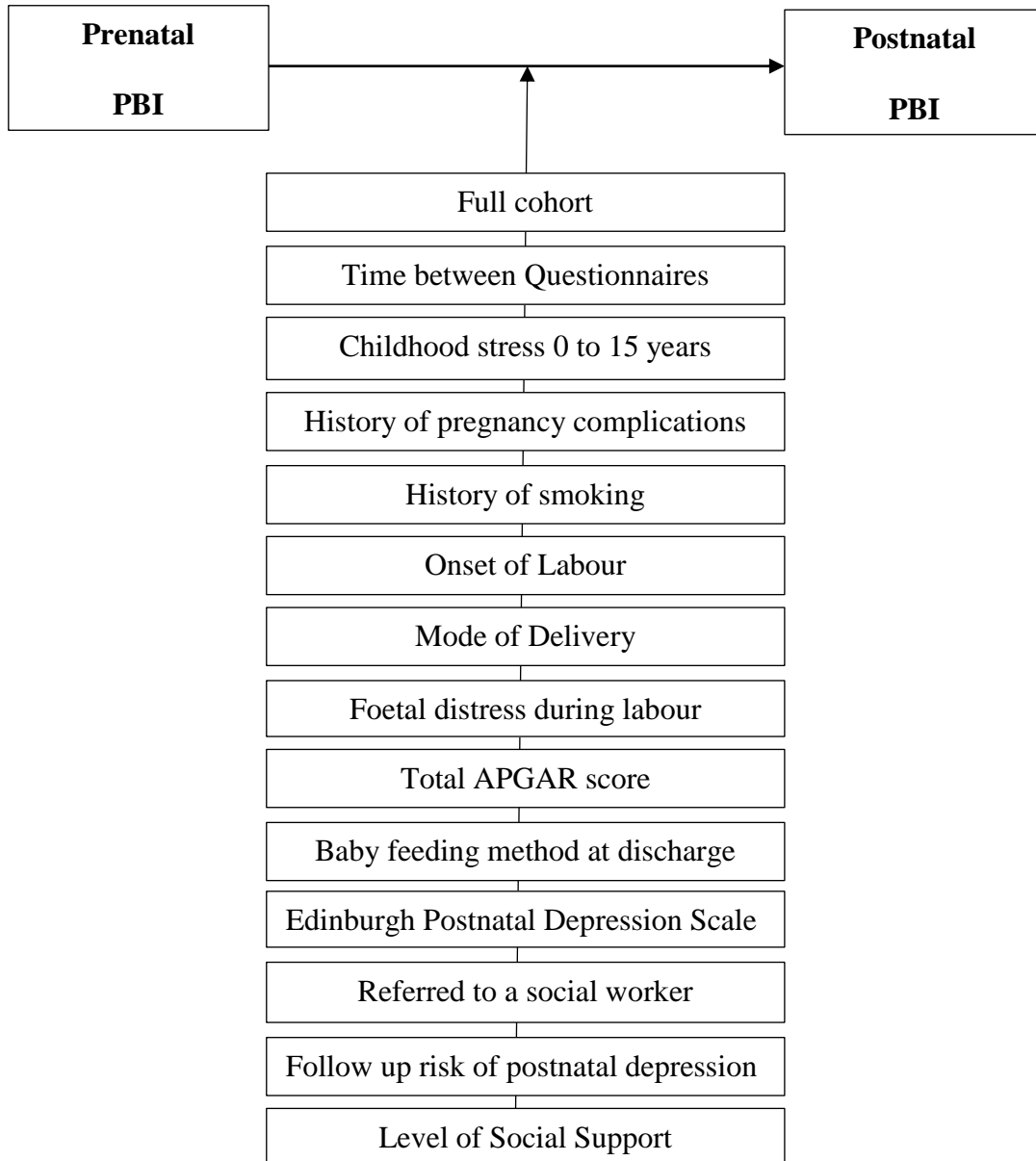
Structure of the Parental Bonding Instrument items and factors as analysed using Exploratory Factor Analysis.



Note. Item 8 was omitted due to an insufficient factor loading.

9.12 Diagram for Chapter 5

Stability of the Parental Bonding Instrument before delivery compared to measurement of Parental Bonding Instrument after childbirth and factors that may reduce this stability.



9.13 Diagram for Chapter 6

The likely factors that may mediate the association between parental bonding and poor mental and physical health outcomes.

