



MASTER THESIS

A mini-review of contributing and impeding factors of secure parental attachment and an investigation if current preventive interventions use these factors to ensure secure parental attachment in the first 1001 critical days after conception in Western countries after 2010

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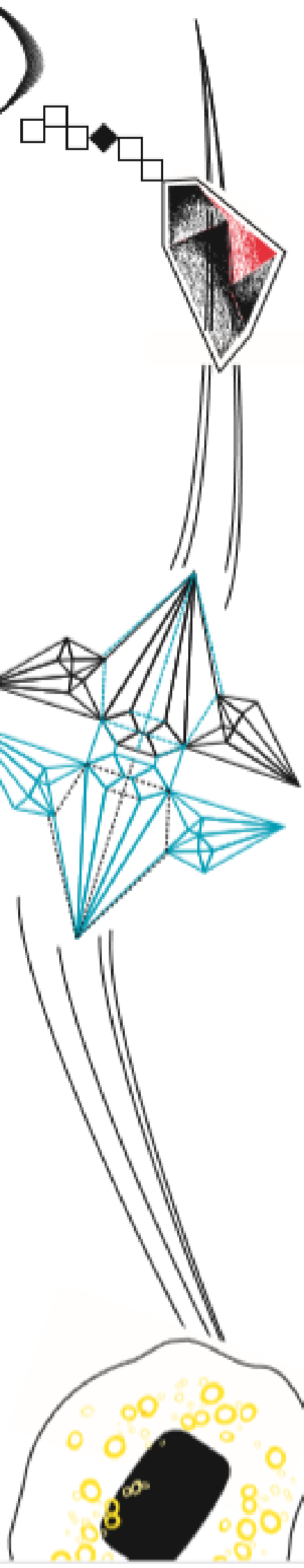
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ABSTRACT

INTRODUCTION: The formation of an attachment bond between parents and an (unborn) infant is an important developmental outcome of an infant's life. Child healthcare professionals focus on the first 1001 critical days after conception, because the attachment bond starts during the prenatal phase and increases during the postnatal phase. For optimal attachment behaviour between parents and an (unborn) infant, preventive evidence-based interventions are developed, in order to assist child healthcare professionals to strive for optimal parental attachment behaviour.

OBJECTIVES: the aims of this study are (1) to identify contributing and impeding factors of secure parental attachment in the first 1001 critical days after conception in Western countries after 2010 and (2) to determine if current preventive evidence-based interventions use these factors to ensure secure parental attachment in Western countries after 2010.

METHODS: Two mini-reviews were conducted in which subjective limits were applied to the scope of the searches. Twenty studies identified a factor of parental attachment and 13 intervention studies met the inclusion criteria and were included in the narrative analysis. The categorization of included studies was based on the ecological model of determinants of parenting with three general sources (individual characteristics of the mother and father, characteristics of the infant and contextual sources of stress and support for the parents).

RESULTS: A total of 16 identified factors were found in 20 included studies of parental attachment. These identified factors were: mental health, childhood history, representation of an (unborn) infant, planning of pregnancy, number of pregnancies, breastfeeding, bedsharing, age, SES/education, hormone composition, infant temperament, preterm birth, marital relationship, parenting stress, household size and job situation. Of these 16 factors, 11 factors were addressed in current preventive evidence-based interventions. Only one factor 'infant temperament' was addressed in all the 13 intervention studies.

DISCUSSION/CONCLUSION: Based on the determinants of parenting, the findings reveal that improved, adjusted or newly developed preventive evidence-based interventions with the aim to strive for optimal attachment behaviour between parents and an (unborn) infant must address at least five factors; mental health, own childhood history, representation of an (unborn) infant, infant temperament and the marital relationship. Regarding the Netherlands, the first essential step is to conduct follow-up research to guarantee the transition of the identified factors of parental attachment within current Dutch preventive interventions to ensure secure parental attachment in the first 1001 critical days after conception.

KEYWORDS

Parental attachment, 1001 critical days, mini-review

1. Introduction

The formation of an attachment bond between parents and infant is an important developmental milestone in every infants' life (Sroufe, 1988). Secure parent-infant interactions during the first years of an infant's life are critical for the construction of attachment representations, because in this period the brain will be shaped, which influences the future infant's social-, emotional- and cognitive development (Dykas & Cassidy, 2011; Rosenblum, Dayton, & Muzik, 2009; Sheridan & Nelson, 2009).

For optimal developmental outcomes of the infant, child healthcare professionals focus on the first 1001 critical days. This is the period starting from conception until the infant is two years old. Attachment during this prenatal and postnatal phase is critical, because it is a powerful predictor of an infant's later social and emotional well-being (Detmar, van Buuren, Schuren, de Wolff, & Clabbers, 2016). Infants that are securely attached to their parents feel confident to function autonomously and gain confidence in their social and other problem-solving competences (Bowlby, 1973). Infants that are not securely attached to their parents have a poor ability to manage emotions and make them more exposed to psychopathology in later life (Mikulincer, Shaver, & Pereg, 2003). As a result of abnormal attachment behaviour, an attachment disorder may develop (Boris & Zeanah, 2005). Regarding the Diagnostic and Statistical Manual of Mental Disorders (DSM-V), a reactive attachment disorder (RAD) can develop with major consequences for the infants' future life (Zeanah & Gleason, 2010).

In order to strive for optimal attachment behaviour during the first 1001 critical days, preventive evidence-based interventions are developed to promote a secure attachment bond. These preventive interventions tend to fit the Western way of thinking, which relates to the infants' autonomy, individuation and exploration. It is acknowledged that attachment theories are presently biased towards the Western, industrialized societies (Rothbaum, Weisz, Pott, Miyake, & Morelli, 2000). Infants growing up in Western countries are exposed to different contextual factors as opposed to infants growing up in developing countries (Van IJzendoorn & Bakermans-Kranenburg, 2010). This means that the area of focus is in Western countries and it could be interesting to search for contributing and impeding factors of secure parental attachment during the first 1001 critical days after conception in only Western countries.

Due to the growing number of academic literature on attachment behaviour in general, contributing and impeding factors which are investigated in research starting from 2010 are included in this study. In a previously conducted meta-analytic study of Yarcheski, Mahon, Yarcheski, Hanks, and Cannella (2009) prenatal factors of maternal-fetal attachment before 2010 were investigated and they found 14 influential factors that only focussed on attachment behaviour in the prenatal phase.

In the present study, the aim is (1) to identify contributing and impeding factors of secure parental attachment in the first 1001 critical days after conception in Western countries after 2010 and (2) to determine if current preventive evidence-based interventions use these factors to ensure secure parental attachment in Western countries after 2010.

As far as we now, there are no earlier review-studies conducted that search for both contributing and impeding factors during the prenatal and postnatal phase or in the first 1001 critical days after conception in Western countries after 2010.

1.1 Background theory

1.1.1 Parental attachment theories

Since the development of the attachment theory of Bowlby (1958), the natural tie between mother and infant became well studied. Bowlby (1958) indicated that an infant develops a strong libidinal tie to a mother-figure within the first 12 months of an infant's life. Because of this, Bowlby could be seen as the formal creator of the attachment theory which later resulted in two evolving pathways, shown in Figure 1. (1) The upper pathway emphasizes the development of prenatal attachment theories, and (2) the lower pathway emphasizes the development of postnatal attachment theories. Eventually, the two pathways are combined, (3) which results in a combination of prenatal and postnatal attachment theories. As represented in Figure 1, the development of attachment theories is schematically visualized.

The first pathway follows prenatal attachment theories that focus on the attachment of the mother towards the fetus. Rubin (1967) was the first researcher who argued that attachment starts before birth and investigated the attainment of the maternal role. Rubin (1967) concluded that the prompt bond between postnatal mother and infant is a result of prenatal attachment processes initiated by the mother. However, Cranley (1981) was the formal creator of the theoretical construct of prenatal attachment focusing on behaviour

and defined it as “the extent to which a woman engage in behaviours that represent an affiliation and interaction with their unborn child” (p. 282). Although, to include also intentions, attitudes and values, Muller (1993) suggested that thoughts and fantasies of mothers should also be included into the definition of prenatal attachment. The definition of Muller (1993) reads as “the unique relationship that develops between a woman and her fetus. These feelings are not dependent on the feelings the woman has about herself as a pregnant person or her perception of herself as a mother” (p. 11). Condon (1993) suggested that prenatal attachment should be described as the developing relationship in which the mother seeks “to know, to be with, to avoid separation or loss, to protect and to identify and gratify the needs of the fetus” (p. 359). The definitions of Cranley, Muller and Condon focus on the attainment of the maternal role. This indicates that prenatal attachment theories only focus on the affiliation of the mother towards the fetus. Besides, it is the mother that experiences a physical connection to the fetus during the prenatal phase, indicating that maternal-fetal attachment is a process initiated by the mother.

In addition, paternal-fetal attachment focus on the affiliation of the father towards the fetus, this prenatal attachment process is thus initiated by the father. However, this attachment process is different for fathers in comparison to mothers, because fathers are not physically connected to the fetus and most of the paternal-fetal attachment is psychological in nature (Weaver & Cranley, 1983). Moreover, a precise definition of paternal-fetal attachment cannot be found in academic literature.

The second pathway shows postnatal attachment theories that focus on the attachment of an infant to their parents and in the opposite direction, the attachment of parents towards their infant. Bowlby

(1969) extended his previous work on the attachment theory and indicated that attachment is a reciprocal behavioural process initiated by the infant to ensure survival by securing proximity to the mother. The attachment behaviour of the infant is only biological and includes behaviours such as approaching, following, clinging, smiling, crying and calling. A close colleague of Bowlby, Mary Ainsworth (1978) argued about an affective appraisal of the mother's behaviour to indicate that the infant's contribution to the attachment process is more than biological. In a standardized laboratory situation the development of infant-mother attachment is assessed based on the activation of attachment behaviour between mothers and one year old infants. This test is widely known in academic literature as the ‘Strange Situation’ Procedure (SSP) and it observes how exploratory behaviour is affected by mother-present, mother-absent or other conditions (Ainsworth & Bell, 1970). The responses of infants could be categorized in four classifications of attachment behaviour; (1) secure, the mother is the ‘secure base’, whereas the infant shows signs of missing the parent during separation and greeting the parent during reunion; (2) insecure-avoidant, the infant shows little or no distress during separation and avoids or ignores the parent during reunion; (3) insecure-ambivalent, the infant is highly distressed by separation and seeks for signals of contact during reunion, but the parent shows strong resistance; (4) disorganized or disoriented, the infant indicates a disruption or flooding of the attachment system (e.g. by fear)(Ainsworth, 1978). These four classifications of (in)secure infant-attachment are still the golden standard in research to assess the quality of infant-parent attachment. However, to examine if possibly a reactive attachment disorder (RAD) exists, DSM-V is used by child healthcare professionals (Boris & Zeanah, 2005).

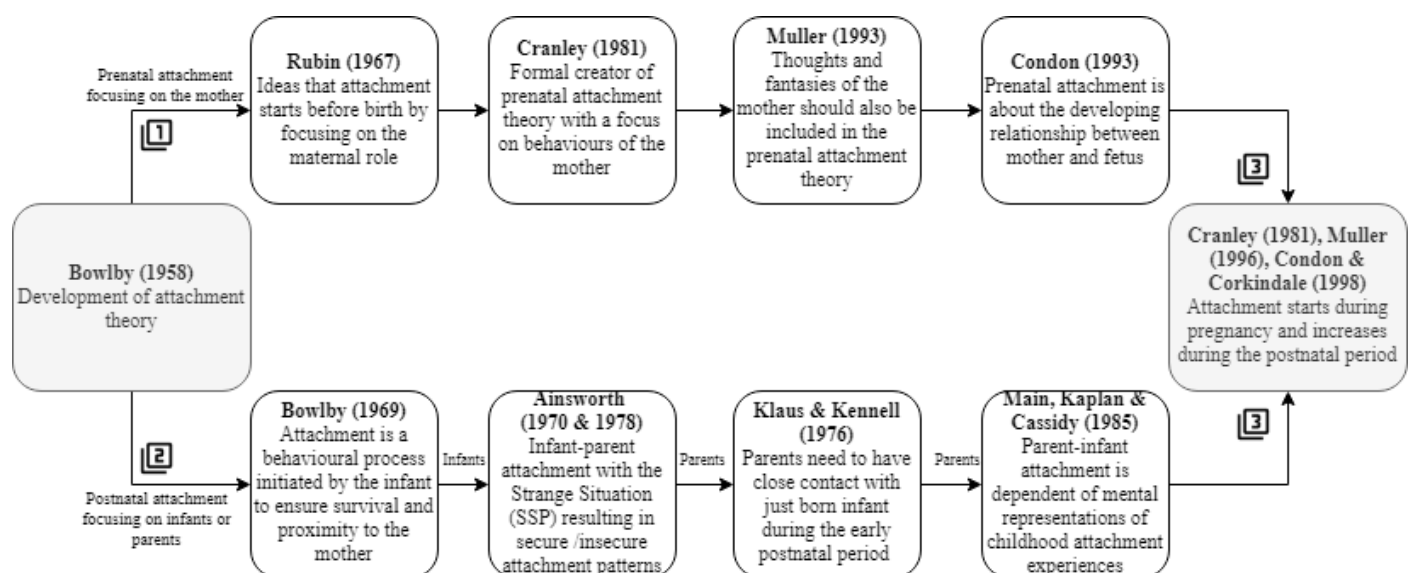


Figure 1. Development of attachment theories

At the same time, parent-infant attachment received some attention due to research of Klaus and Kennell (1976) who argued that parents need to have close contact with their just born infant. They indicated that parents need to build an attachment relationship with their infant in the sensitive period immediately after birth, because attachment in the early postnatal phase results in optimal developmental outcomes in the infant's future life. Furthermore, parent-infant attachment also received attention based on research of Main, Kaplan, and Cassidy (1985), they argued that parents' mental representations of childhood attachment experiences strongly influences the quality of parent-infant attachment (Van IJzendoorn, 1995). The differences in the mental representations of attachment in parents are related to early relationships and attachment-related events and for the adult's sense of the way these relationships and events have affected the adult personality (George, Kaplan, & Main, 1985). The mental representations of attachment have determined the parents' ability to sensitivity and responsiveness to their infant's attachment signals and thus influence the quality of parent-infant attachment (Main et al., 1985).

Eventually, the two pathways including the theories of prenatal and postnatal attachment are combined, proposing that the stronger the prenatal attachment, the stronger the postnatal attachment (Cranley, 1981). In the study of Muller (1996), evidence was found that there is a correlation between prenatal and postnatal attachment, indicating that attachment starts during pregnancy and in the early postnatal period the feelings of attachment are increasing (Condon & Corkindale, 1998). This means that prenatal and postnatal attachment theories are interrelated, showing that a strong prenatal attachment is a precursor for a strong postnatal attachment.

In the present study, the term 'parental attachment' is used which refers to both the prenatal and postnatal attachment processes. Parental attachment indicates that each parent (mother and father) develops a long-lasting and stable affective bond with their fetus or infant. After birth, parental attachment could be seen as a two-way reinforcing process depending on both the mother and father and their infant (Rees, 2007; Stern, 1995). Based on the parental functioning, the ecological model of determinants of parenting of Belsky (1984) is used to explain which determinant the contributing or impeding factor belongs to ensure a secure parental attachment in the first 1001 critical days after conception.

1.1.2 Determinants of parenting

The ecological model of the determinants of parenting of Belsky (1984) suggests that there are three general sources of influence on parental functioning. These determinants are identified as the individual characteristics of the mother and father, the characteristics of the infant and the contextual sources of stress and support for the parents. The determinants are presented schematically in Figure 2. The ecological model assumes that parenting is directly influenced by the personality/behaviour and developmental history of the individual mother and father, by the characteristics of the individual infant and from a broader social context; including the marital status, social network and job of the parents (Belsky, 1984). Belsky (1984) places the determinants in order of effectiveness and in Table 1, the determinants with corresponding supporting characteristics are mentioned. These determinants with corresponding supporting characteristics are used in the present study to indicate in which determinant problems of attachment occur and thus for the categorization of included studies with contributing and impeding factors of secure parental attachment.

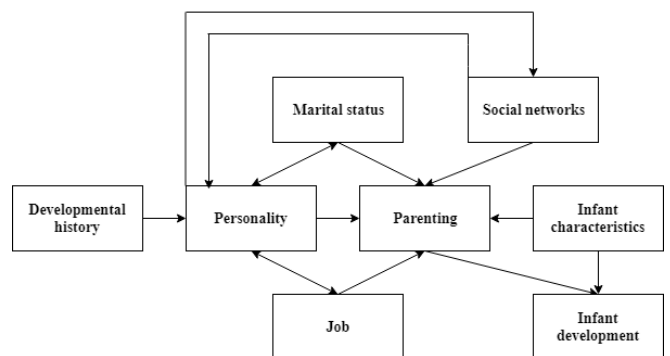


Figure 2. *Ecological model of determinants of parenting*

Table 1. *Determinants and corresponding characteristics*

Determinant (ranked on effectiveness)	Characteristics
(1) Individual characteristics of the mother and father	- Developmental history - Personality/behaviour
(2) Characteristics of the infant	- Infant characteristics - Infant development
(3) Contextual sources of stress and support for the parents	- Marital status - Social networks - Job

1.1.3 Preventive interventions for optimal parental attachment

With the increasing number of academic literature being written concerning parental attachment theories, multiple evidence-based interventions are established. These preventive interventions are aimed to enhance the life expectations of the youth and try to stimulate their

developmental and educational potentials. Early interventions, for instance during the prenatal period or in the first years of an infant's life, may be most effective in preventing less optimal or even deviant developmental pathways (Bakermans-Kranenburg, Van IJzendoorn, & Juffer, 2003). Therefore, early preventive interventions to foster the optimal developmental outcomes of infants are highly recommended. A meta-analysis of 70 studies reviewing preventive evidence-based parental attachment interventions found that brief interventions which intervene on behaviour problems during infancy are the most effective in improving secure attachment between parents and infant (Bakermans-Kranenburg et al., 2003). Thus, efforts in shaping and evaluating preventive interventions for parents during the prenatal and postnatal phase gain much more attention, which emphasizes the importance of infancy as a critical period for development of parent-infant attachment (Bakermans-Kranenburg et al., 2003).

The period in which a substantial amount of preventive interventions of parental attachment concentrate on is known as the first 1001 critical days. This is the period starting from conception until the infant is two years (Detmar et al., 2016). It is during the period of prenatal development (germinal, embryonic and fetal stage), infancy and toddlerhood that the brain is growing and developing with maximum speed. Optimal brain development during this critical period influences the future infant's social-, emotional- and cognitive development (Rosenblum et al., 2009; Sheridan & Nelson, 2009). In the first two years of an infant's life, the mother and father or another primary attachment caregiver is the infant's environment and any interruption between them is stressful. Moreover, it can be said that the parents of an infant actually build an infant's brain and when the infants' neurological development is threatened by attachment disruption, this influences the rest of the infant's life (Balbernie, 2001; Belsky & de Haan, 2011). Thus, preventive evidence-based parental attachment interventions could be implemented during the first 1001 critical days to strive for optimal parental attachment behaviour.

1.2 Purpose of the study

The purpose of this study is to identify contributing and impeding factors of secure parental attachment through a review of the literature and to determine if current preventive interventions use these factors to ensure secure parental attachment. With the understanding of the attachment theories, the determinants of parenting and the acknowledgement that early preventive

evidence-based interventions strive for optimal parental attachment, the following research questions are formulated. In other words, the objective of this study is to conduct two mini-reviews to answer the following two research questions:

RQ1. *Which factors contribute and impede a secure parental attachment in the first 1001 critical days after conception in Western countries after 2010?*

RQ2. *Which current preventive interventions use these contributing or impeding factors to ensure a secure parental attachment during the first 1001 critical days after conception in Western countries after 2010?*

2. Methods

This review is written based on the mini-review protocol of Griffiths (2002). Subjective limits were applied on the scope of the searches to ease the amount of material manageable with limited resources. The research questions are referred to as RQ1 and RQ2.

2.1 Search strategy

The information source used for systematically conducting the literature search was the online database 'Scopus'. This is Elsevier's abstract and citation database with peer-reviewed journals in the top level subject field of life sciences, social sciences, physical sciences and health sciences. The subject field of Scopus matches the purpose of this study and therefore Scopus was used for selecting studies to include in the mini-review. Regarding RQ1, the search strategy consisted of four elements, each element imparted the following search terms; (a) attachment OR bond*; (b) maternal OR paternal OR parental OR mother OR father OR parent; (c) prenatal OR postnatal OR antenatal OR postpartum OR "early parenting" OR "early parenthood"; (d) factor OR predict*. Combinations of all the four elements were made in each search. Regarding RQ2, the search strategy consisted of four elements, each element imparted the following search terms; (i) attachment OR bond*; (ii) maternal OR paternal OR parental OR mother OR father OR parent; (iii) prenatal OR postnatal OR antenatal OR fetus OR infancy OR toddlerhood; (iiii) intervention OR program*. Combinations of all the four elements were made in each search.

The results for RQ1 and RQ2 were narrowed by publishing date starting from 2010, by documentation type (articles only) and by language (English only). Regarding RQ1, the initial search yielded 570 studies.

Regarding RQ2, the initial search yielded 323 studies. All studies were published between 2010 and 2019. These studies were included for further analysis and screened based on title, abstract and full text. One reviewer screened the eligibility of the studies.

2.2 Study selection

The studies that were selected for further analysis had to meet the inclusion criteria. The same inclusion and exclusion criteria were used for RQ1 and RQ2, see Table 2. The inclusion and exclusion criteria were devised through initial searches in the existing academic literature and through practical experiences of a child healthcare professional working in youth healthcare.

Table 2. *Inclusion and exclusion criteria*

Inclusion criteria	Exclusion criteria
<ul style="list-style-type: none"> - Biological parents, non-biological partners of mothers and same-sex lesbian couples. - Parents with all ranges of socio-economic status (SES) and education level and an age range between 16-50 years old. - Pregnancies resulting in caesarean sections, twins/triplets and preterm births. - Publishing date starting from 2010, written in English and study designs were qualitative or quantitative. - The area of focus was Western-Europe, America, Canada, Australia or New-Zealand. 	<ul style="list-style-type: none"> - Surrogate mothers, foster parents and adoptive parents. - Parents that were younger than 16 years old and older than 50 years old. - Pregnancies that resulted in still births. - Publishing date starting before 2010, written in a language other than English and study designs of existing reviews or policy documents or government reports. - The area of focus was not Western-Europe, America, Canada, Australia or New-Zealand.

2.3 Critical appraisal

The critical appraisal aims to discover if the methods and the results of the studies are valid. The validity, reliability and generalizability were used for systematically appraising the quality of the included studies. First, the validity was appraised based on the appropriateness of tools, processes and data and whether or not the design of the study takes the risk of bias and confounding factors into account. Second, the reliability was appraised based on the possibility of the exact replicability of processes and results, including the trustworthiness of used methodology. Last, the generalizability was appraised based on the strength of recommendations for practice, checking for the sample size and the social context wherein the study was conducted (Leung, 2015).

2.3.1 Regarding RQ1

The studies that were included in the analysis were appraised based on the validity, reliability and generalizability. To get a thorough understanding of the characteristics of every included study, the features of the included studies were summarized (see Appendix A for a list of all the features). The features mentioned were the objective of the study, the study design, the study sample (n), if there was ethical approval for obtaining the study, if the respondents were asked for informed consent, the location of the study, the measurement instruments, the time phase within the 1001 critical days and the main findings of the study. These features were chosen, because these features contain important information that should be critically appraised. Moreover, with regard to the validity, reliability and generalizability, studies were excluded from further analysis due to a small study sample (studies with less than 100 respondents that completed the entire study were excluded, because they were less generalizable in comparison with studies including more than 100 respondents). Afterwards, the process of selecting appropriate studies was finalized and resulted in n=20 included studies that were used in this mini review. A flowchart of the selection process of the included studies can be seen in Figure 3 and the overview of some features of the included studies can be seen in Table 3.

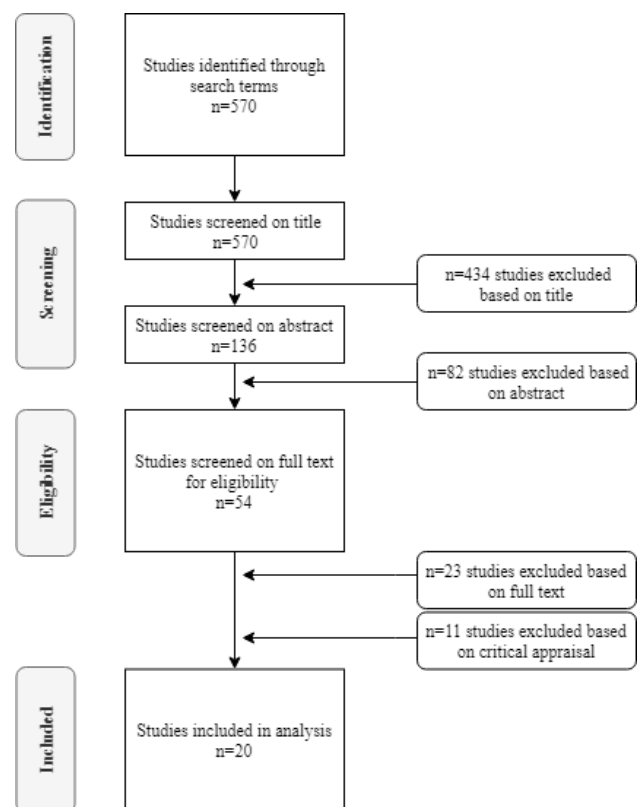


Figure 3. *Flow-chart of the selection process*

Table 3. Overview of all the features in included studies of parental attachment

Author	Objective of study	Study design	Study sample (n)	Location	Time phase	Main finding of the study
Camarneiro et al. (2017)	Aim to observe differences between maternal and paternal prenatal attachment as a function of sociodemographic and clinical/obstetric factors	Correlational study	n=814 mothers and fathers, resulting in n=407 couples	Central Portugal	Prenatal T2	Significant differences in maternal prenatal attachment for age, education, SES, pregnancy planning, previous pregnancies, pregnancy interruptions and gestational age. For paternal prenatal attachment in age, number of children, SES, occupational status, family household, pregnancy planning
Condon et al. (2013)	Aim to investigate the relationship between a father's antenatal attachment to his fetus and his subsequent attachment to his infant at 6 and 12 months postnatally	Longitudinal and cross-sectional study	n=904 fathers were recruited and n=204 first time fathers completed study	Australia	Prenatal T2, Postnatal M3, Postnatal M6 and Postnatal M12	Strong continuity of attachment across these three assessment points as well as the important influence of the man's partner relationship and mental well-being on his attachment
Dayton et al. (2019)	Aim to examine the influence of the accumulation of psychiatric conditions (psychological distress) on prenatal bonding in a sample of mothers and fathers who reported high levels of exposure to contextual adversity	Longitudinal study	n=51 expectant mothers and n=51 biological fathers, total = n=102. Risk group: exposure to environmental stressors such as poverty and violence	Detroit, Michigan USA	Prenatal T3	Mothers: psychological distress (PTSD) is associated with maternal-fetal bonding. Fathers: history of child-maltreatment and views of fathering are associated with bonding
Dekel et al. (2019)	Aim to investigate whether PP-PTSD symptoms limit maternal attachment even more than non-childbirth PTSD and whether PP-PTSD interferes with maternal attachment above and beyond premorbid factors	Cross-sectional study	N=685 mothers	Massachusetts, USA	Postnatal M6	Childbirth-induced posttraumatic stress (PTSD) may interfere with the formation of maternal attachment. PP-PTSD predicted less maternal attachment above and beyond pre-birth psychiatric conditions, acute distress in birth and lack of breastfeeding
Evans et al. (2012)	Aim to investigate the relationship between the predictor variables of experiential avoidance, relationship satisfaction, prenatal expectations (compared to postnatal experience) and postpartum support and the criterion variables of maternal attachment, psychological symptoms and maternal responsiveness after controlling for birth weight	Correlational study	n=127 mothers who gave birth to preterm born infants	Queensland Australia	Postnatal M17	A preterm birth negatively impacts maternal attachment, maternal psychological symptoms and maternal responsiveness. For maternal attachment only no experiential avoidance and prenatal experiences are significant contributors
Goecke et al. (2012)	Aim to investigate associations between prenatal attachment of adult first-time mothers to the unborn child, perinatal factors and levels of depression before and up to 18 months after delivery	Longitudinal Study	n=161 first time mothers without risk factors, n=132 completed the study	Germany	Prenatal T1, Postnatal M1, Postnatal M6 and Postnatal M18	Depressive symptoms during the last trimester and postpartum show stability over time even up to 18 months postpartum. The quality of prenatal attachment was negatively correlated with depressive symptoms during pregnancy and 3 weeks and 6 months postpartum. Mode of delivery and perinatal injuries have a significant influence on development of postpartum depressive symptoms and could be considered as risk factors
Hall et al. (2015)	Aim to investigate links between prematurity, perceived child-rearing history and emotional bonding with a new-born infant in both mothers and fathers	Longitudinal study	n=406 (include both mothers and fathers); separated in three parts related to preterm births	South of the Netherlands	Postnatal M1 and Postnatal M6	Mothers of preterm infants report higher feelings of bonding than mothers of full-term infants (no differences for fathers). Bonding with infant was strongly influenced by parents' perceptions of their own child-rearing history in both mothers and fathers of full-term and preterm infants
Kerstis et al. (2016)	Aim (1) to evaluate associations between maternal and paternal depressive symptoms and impaired bonding with their infant. (2) to determine the associations between parents' marital problems and impaired bonding with their infant	Longitudinal study	n=727 couples (both mothers and fathers), n=1454 in total	Uppsala in Sweden	Postnatal M1 and Postnatal M6	Prevalence of impaired bonding was highest among couples in which both spouses had depressive symptoms. Impaired bonding was associated with higher EPDS scores in both mothers and fathers, as well as with experiencing a deteriorated marital relationship. Depressive symptoms at 6 weeks postpartum are associated with impaired bonding with the infant at 6 months postpartum for both mothers and fathers
Ludmer et al. (2018)	Aim to examine maternal oxytocin receptor (OXTR, rs53576) genotype and cortisol secretion as moderators of the relation between maternal childhood maltreatment history and disorganized mother-infant attachment in the SSP.	Cross-sectional study	n=314 low-risk mother infant dyads	Toronto, Canada	Postnatal M17	Maternal OXTR genotypes and cortisol secretion moderate the relation between maternal history of childhood maltreatment and mother-infant attachment disorganization in the context of the Strange Situation Procedure

Mitchell et al. (2015)	Aim to investigate the relationship between bed-sharing and mother-infant bonding	Cross-sectional study	n=400 mothers selected, n=172 completed study	Auckland, New-Zealand	Postnatal M6	There is an inverse association between bed-sharing and maternal-infant bonding
Moe et al. (2018)	Aim to investigate the prospective association between maternal attachment styles during pregnancy and parenting stress when infants are 12 months old.	Longitudinal study	n=1041 mothers wanted to participate, but n=1036 mothers started at T1. n=744 completed study	Norway	Prenatal T3 and Postnatal M12	Maternal attachment style assessed during pregnancy predicted parenting stress at twelve months after birth.
Muzik et al. (2013)	Aim to explore the role of maternal psychopathology (depression and posttraumatic stress) and socioeconomic risk among women with childhood abuse and neglect histories and its impact on their attitudes towards parenting and their relationships with their infants	Longitudinal Study	n=150 mother-infant dyads. N=97 Ca+ (childhood abuse) and N=53 Ca- (no childhood abuse)	USA	Postnatal M1, Postnatal M4, Postnatal M12 and Postnatal M17	All women increased in bonding with their infant over the first 6 months postpartum, women with postpartum psychopathology (depression and posttraumatic stress disorder [PTSD]) showed consistently greater bonding impairment scores at all timepoints.
Nolvi et al. (2016)	Aim to examine the effects of maternal postnatal depressive and anxiety symptoms and infant temperament traits on mother-infant bonding using both mother and father reports of infant temperament	Longitudinal Study	n=102 mothers and n=62 fathers completed whole study total = n=164	Finland	Prenatal T2, Prenatal M3, Prenatal M6	After controlling for maternal symptoms of depression and anxiety, mother-reported infant positive emotionality, measured by infant smiling was related to better mother-infant bonding
Rossen et al. (2016)	Aim to examine the extent to which mother-fetal bonding, substance use and mental health through pregnancy predicted postnatal mother-infant bonding at 8 weeks	Longitudinal Study	n=372 mothers	Wales, Australia	Prenatal T2, Prenatal T3 and Postnatal M1	The higher antenatal bonding across all trimesters in pregnancy, predicted higher bonding to the infant 8 weeks postnatally. Symptoms of depression and stress during pregnancy are related to bonding 8 weeks postnatally. No association for substance use.
Rowe et al. (2013)	Aim to describe self-reported maternal-fetal emotional attachment in adolescent women over the course of pregnancy compared with adult pregnant women and identify risk factors for poor attachment	Longitudinal study	n=194 adolescents and n=184 adults were invited in which at the end n=132 adolescents and n=68 adults completed whole study. Adolescents are women below 20 years old	Melbourne Australia	Prenatal T1, Prenatal T2 and Prenatal T3	Adolescents report slower development of antenatal emotional attachment than adults
Schmidt et al. (2016)	Aim to determine the predictive role of antenatal worry and depressive rumination for maternal-fetal attachment and the development of maternal depression and anxiety during pregnancy in a non-clinical sample	Longitudinal study	n=245 mothers, however final sample is n=215 mothers	Osnabruck Germany	Prenatal T2 and Prenatal T3	Depressive rumination during early pregnancy predicts impairments in the maternal-foetal attachment towards the end of pregnancy and that worrying during early pregnancy predicts depressive and anxious symptoms towards the end of pregnancy
Tani et al. (2018)	Aim to analyse if there is an association between pregnant women's attachment to her baby before and after birth and their relationship with their own mothers	Longitudinal study	n=201 first time mothers	Prato, Italy	Prenatal T3 and first 2 days after birth (M1)	Women who had positive relationships with their own mothers also had positive attachments to their unborn babies and in the period immediately after birth
Tharner et al. (2012)	Aim to investigate whether breastfeeding duration during the first 6 months is associated with maternal sensitive responsiveness, attachment security and attachment disorganization in a large prospective birth cohort	Longitudinal study	n=881 mother-infant dyads, but n=675 were fully included	The Netherlands	Postnatal M2, Postnatal M6 and Postnatal M14	Longer duration of breastfeeding was associated with more maternal sensitive responsiveness as well as more attachment security and less attachment disorganization.
Vreeswijk et al. (2014)	Aim to investigate father's experiences during pregnancy, specifically focussing on the relationship they have with their unborn child	Correlational study	n=301 expectant fathers, n=243 gave consent to conduct a home-visit participated in the semi-structured interview	The Netherlands	Prenatal T2	Fathers who reported a higher quality of prenatal attachment were more likely to have balanced representations of their unborn children, whereas fathers with a lower quality of attachment were more likely to show disengaged representations. The quality of fathers' self-reported prenatal attachment was higher when fathers experienced fewer symptoms of depression and anxiety during pregnancy, when they were younger, and when they expected their first child.
Wynter et al. (2016)	Aim to identify factors significantly associated with self-reported father-to-infant attachment at six months postpartum, including individual factors such as personality traits and psychological well-being, infant crying and fussing and contextual sources of support	Longitudinal study	n=330 fathers completed baseline interview, n=270 completed whole study	Victoria, Australia	Postnatal M1 and Postnatal M6	Poorer quality father-to-infant attachment was significantly associated with personality traits like oversensitivity, more symptoms of depression and anxiety, poorer quality of partner relationship and more frequent partner criticism of infant care

2.3.2 Regarding RQ2

The studies that were included in the analysis were critically appraised and to get a thorough understanding of the characteristics of every included study, the features of the included studies were summarized (see Appendix B for a list of all the features). The features mentioned were the objective of the study, name of the intervention, the study design, the study sample (n), the location of the study, characteristics of the intervention, time investment, the time phase within 1001 critical days of when the intervention was performed, the target group of the intervention (parents or infant), outcome measurement instruments and the result of the intervention. These features were chosen, because these features contain important information that should be critically appraised. Moreover, with regard to the validity, reliability and generalizability, studies were excluded from further analysis for reasons of ineffectiveness. Two studies were excluded from the analysis, because they were not proven to be effective, which was assessed in a randomized controlled trial design.

Furthermore, a selection of the included studies of RQ2 were updated versions of earlier developed interventions. This means that the format of the earlier developed interventions was used in the updated versions, but the format was optimized for better research outcomes (for instance in different study populations). Therefore, the researcher decided to include also the earlier developed interventions and these were Triple P (Sanders, 1999), Steps Toward Effective and Enjoyable Parenting (STEEP) (Erickson & Egeland, 2004) and Circle of Security (COS) (Hoffman, Marvin, Cooper, & Powell, 2006).

Thus, these studies were all included in the analysis, because these are highly recommended and are used in practice in the country of development. In addition, a flowchart of the selection process of the included studies can be seen in Figure 4 and an overview of all the features of the included studies can be seen in Table 4.

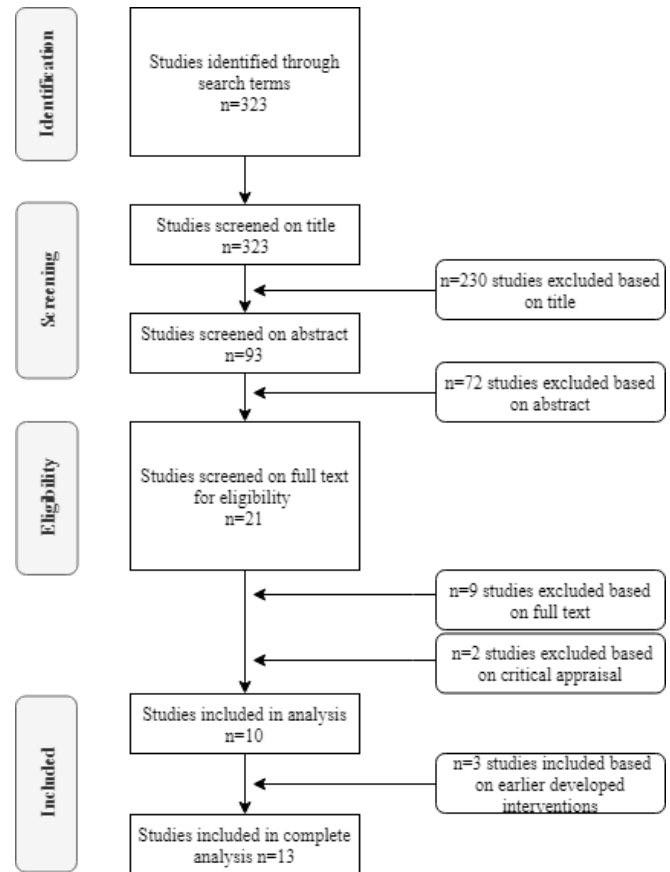


Figure 4. Flow-chart of the selection process

Table 4. Overview of all the features of the included intervention studies

Author	Country	Objective	Name intervention	Study design	Study sample (n)	Characteristics intervention	Time investment
Blizzard et al. (2018)	USA	Aim to examine the impact of the IBP on changes in attachment-based caregiving behaviours (warmth, sensitivity and intrusiveness) in a randomized controlled trial in which families were randomly assigned to receive the IBP or standard care	Infant behaviour Program (IBP)	RCT	60 mother-infant dyads. IBP group n=28 and CAU group n=30, n=46 families completed whole study. Mean infants age was 13,52 months old.	The IBP is a home-based adaption of the Child-Directed Interaction (CDI) phase of the Parent-Child-Interaction Therapy (PCIT) for high-risk infants and their families. Parents are taught to follow their infant's lead in play by increasing their use of behaviourally based parenting do skills and decreasing their use of behaviourally based parenting don't skills. PRIDE is used for the DO-skills (P, praise the infant, R, reflecting the infants speech, I, imitating the infants play, D, describing the infants behaviour, E, enjoyment in the play)	Postintervention of the IBP and 3 and 6 month-follow up. Sessions of the intervention took place weekly and took 1-1,5 hours. Max 7 sessions and average of 6,1 sessions per family
Macdonald et al. (2018)	Northern Ireland	Aim to determine whether the New Baby Programme, compared with routine antenatal and postnatal care, can improve infant attachment and maternal sensitivity among pregnant women with complex social factors and the quality of maternal-child relationships	New Baby Programme (NBP)	RCT Protocol	Aim to recruit 50 women and randomize equally. Risk population: mothers with social isolation/ low family support / father in prison, intimate partner violence, substance misuse, maternal stress or mental health problems, current involvement with social services, history of care or care leaver, abnormal reaction to pregnancy	The NBP aims to promote mental health and well-being in pregnancy, maximise secure attachments and enhance sensitive parenting and infant cognitive development. Goals were to improve the birth outcomes, to promote secure attachments and to promote child health and development.(1) Improve birth outcomes (prenatal): mother-related: to reduce stress reduce substance use, increase positive health behaviours, increase coping strategies, improve physical and mental health, increase informal support and increase professional/service support --> for infant: born >37 weeks gestation and reduced admission to NICU. (2) promote secure attachments and promote child health and development: for the child: securely attached, good developmental outcomes --> mother: breastfeeds, sensitive and responsible caregiving and connecting to community or other services	Measurements are at baseline (prenatal T2) and Postnatal M2, M6 and M12. Health visitors are performing home visits every month after baseline. Weekly home visits from birth till M2 and fortnightly visits till the infant is M5 and monthly visits till the infant is M24
O'Neill et al. (2018)	Canada	Aim to assess the effectiveness of 'Make the Connection' (MTC), an attachment-focussed parenting programme in fostering maternal attitudes thought to underlie sensitive responding	Make the Connection (MTC)	Controlled trial	180 mothers with infants aged 3 to 8 months. All participants were 'at risk' of being a first-time parent, socially isolated, low education, less than 25 years old, parenting alone, lacks confidence, poor infant sensitivity, postpartum depression	MTC aims to improve paternal attitudes through activities designed to enhance the parent's ability to take the baby's perspective and understand infant communication, with the ultimate goal of establishing felt security for the infant. MTC takes a behavioural orientation and each session includes three segments: parent and baby time, parent discussion and videotaping/refreshments. (1) Parent-baby time: parents interact with their infant through guided activities and reflect on their responses. (2) Parent discussions: discussion about parents' own experiences and those of the infant. (3) Videotaping: parents are videotaped with their infants and socialize. These are all group sessions containing 8-10 parents.	MTC contains of nine 90-minute weekly sessions
Svanberg et al. (2010)	England	Aim to report details about the development, implementation and evaluation of a clinical programme that used a targeted prevention approach following a universally-offered screening of parent-infant interactions	Sunderland Infant Programme	Controlled trial	Intervention group at baseline consisted of 241 mother-infant dyads, however only 134 dyads completed entire intervention. Control group consisted of 82 dyads however 58 completed the control group. In total 192 mother-infant dyads in this study	Aim of the Sunderland Infant programme was to increase the proportion of securely attached children within a sample of families receiving services through England's universal Sure Start programme(government funded). The CARE-Index was used for measure of maternal sensitivity. Three groups were made (high risk, struggling and sensitive enough) and received different interventions. 1. Sensitive enough: one visit to provide positive feedback based on the videotape. Struggling and high risk: intervention was tailored based on specific dyads. 2. Struggling: four reflective video feedback sessions (topics: develop mindfulness, acknowledging ambivalence, mothers own childhood and impact of separations. 3. High risk: Received four video feedback sessions + psychotherapy	2 weeks Postpartum information was given, Six weeks postnatal consent form, 8-12 weeks postnatal videotape for CARE-index. Resulted in three groups (high risk, struggling and sensitive enough)
Thomas et al. (2014)	Melbourne, Australia	Aim to examine the acceptability and effectiveness of an antenatal group intervention designed to reduce the severity of depression and anxiety symptoms and improve maternal attachment in pregnant women with current/emerging depressions	Antenatal group program	Pretest-Posttest longitudinal design	Total of 48 expectant mothers participated in the intervention and n=37 completed at least 80%. Risk group for mental health problems (depression and anxiety)	An antenatal group program designed to reduce the severity of depression and anxiety symptoms and improving maternal attachment in pregnant women with current or emerging depression and anxiety. Sessions consisted of four components: several behavioural self-care strategies, psycho-educational component, interpersonal therapy (IPT), parent-infant component addressing infant attachment needs.	Six two hour sessions every two weeks including two sessions of mothers and partners.
Torres et al. (2011)	Spain	Aim to develop and implement a group-intervention aimed at promoting secure attachment of children in Spain.	Group intervention	Controlled Trial	Total of 24 pregnant women in the T3 agreed to join the study and 16 women in intervention group and 8 women in control group	Group intervention about infant-mother attachment. Started with AAI and 22 sessions during prenatal and postnatal phase. Sessions consisted of elements such as self-knowledge and well-being of parents, relevance of own child rearing experience, healthy development of the first year of the infant, parents' mental representations, importance of partner relationship, role of the father, infant temperament	Six prenatal sessions on a weekly basis and 16 postnatal sessions on two-weekly or monthly basis (22 sessions in total) and a baseline AAI and follow-up SSP.

Sanders (1999)	Brisbane, Australia	Aim to describe the conceptual and empirical foundations of a comprehensive multilevel model of parenting and family support, which aims to better equip parents in their childrearing role	Triple P-Positive Parenting Program	Multiple RCTs were conducted	Theoretical and empirical foundations, so no actual RCT study	The program aims to prevent severe behavioural, emotional, and developmental problems in children by enhancing the knowledge, skills and confidence of parents. It incorporates five levels of intervention on a tiered continuum of increasing strength (based on the severity of the problems). These interventions include a universal; population-level media information campaign for all parents, two levels of brief primary care consultations targeting mild behavioural problems, and two more intensive parent training and family intervention programs for children at risk for more severe behavioural problems	(1) Media strategy; (2) Selective triple P, one session 20 min; (3) 4-session 20-min information based strategy (4) Standard triple P, 10 sessions of 90 min each, Group triple P (8 sessions, 4 2hour group sessions and 4 telephone calls) Self-directed triple P, weekly 15-30min phone calls . (5) enhanced triple P, 9 sessions of 90 min each
Mihelic et al. (2018)	Australia	Aim to experimentally test the hypothesis that provision of parenting support at the transition to parenthood through Baby Triple P will lead to improvements in parental confidence and sense of competence in their abilities as parents	Baby Triple P	RCT Protocol	Approximately 110 couples, so n=110 mothers and n=110 fathers. At risk for unplanned pregnancy/ low education/ low income/ low relationship satisfaction/ low social support/ history of depression/ current depression or anxiety/ low parenting efficacy/ low life satisfaction/ aged 18-21	Baby Triple P is a psychological parenting intervention aimed to prepare new parents for a positive transition to parenthood by teaching them skills in the domains of parenting their baby, looking after their own well-being, as well as maintaining a positive relationship with their partner. Unique aspect of the self-regulatory framework and active skills training to enhance self-efficacy and encourage parents to generalize their learnt skills to when their child is order or to other areas and times of their lives. Both parents and infants were educated in parenting strategies, individual coping skills and partner support skills	Intervention consisted of four two hour sessions during the prenatal phase and four telephone sessions of 30 min when the baby was 6 weeks old and postnatal visits of 10 weeks and 6 months
Hoffman et al. (2006)	USA	Aim to assess the effectiveness of a new group-based intervention protocol, Circle of Security, which was developed by drawing on the dynamics of secure and insecure attachment patterns	Circle of Security (COS)	Pretest-Posttest longitudinal design	75 dyads began the intervention phase and 65 dyads completed Children were between 11-58 months old (mean=21months) Participants lived below poverty line, in violent neighbourhoods and experienced own childhood maltreatment or trauma	COS contains both educational and therapeutic components. Five goals of the protocol are: 1. establish the therapist and group as a secure base in which the caregiver can explore the relationship with the child. 2. Increase caregiver sensitivity and responsiveness. 3. increase caregiver capacity to recognize and understand cues of children. 4. increase caregiver empathy and 5. increase caregiver reflection. These were all group sessions	Intervention consisted of 20 sessions during every week lasted about 75 min (group-intervention)
Ramsauer et al. (2014)	Germany	Aim to evaluate the efficacy of the COS intervention for mentally ill mothers with infants, for the first time in Germany and in a clinical context	Circle of Security (COS)	RCT Protocol	80 mother-infant dyads. Infants are then 4-9 months old. Mothers were mentally ill	COS was designed to alter developmental pathways for at risk parents and their children. Group intervention focuses on the caregiver and his relational capacities in providing child-parent attachment security	Intervention consisted of 20 sessions during every week that lasted about 90 min. Plus one session of 120 min with family
Skovgaard Vaever et al. (2016)	Denmark	Aim to determine whether COS-P as an indicated short group-based educational intervention can lead to	Circle of Security Parenting (COS-P)	RCT Protocol	314 eligible families will be randomly be allocated with a ratio of 2:1 into the COS-P intervention or into the CAU. Mother is screened positive for symptoms of depression	The COS-P manual and video material had been translated to Danish and based on this material, parents are trained to see and understand infant attachment behaviour and especially to learn about infant miscuing attachment signals. Both mother and partner are invited to participate in the group sessions and each group includes 5-7 families	Intervention consisted of 10 sessions during every week and lasted about 90 min
Erickson and Egeland (2004)	USA	Aim to discuss the theory that has guided the research, summarise critical findings from 29 years and illustrate how this research has been used to inform and shape preventive intervention for parents and infants in high-risk circumstances	Steps Towards Effective and Enjoyable parenting	RCT	First time low-income mothers of children 0-23 months old	The overall goals of STEEP are to improve parental knowledge and understanding of child's behaviour and development. Improve parental sensitivity and responsiveness to infant cues, improve parental coping skills and decision making related to life-planning for themselves and their child. Strengthen the family support network, including both formal and informal resources and to improve parents' reflective capacity as it relates to how their relationship history influences their responses to their child	27 months (beginning in T2 and continue till M24). Bi-weekly home-visits that continued till the infant is two years old. Mothers also attend bi-weekly group sessions with other mothers
Suess et al. (2016)	Germany	Aim to replicate and contribute to evidence regarding the effectiveness of the STEEP intervention	Steps Towards Effective and Enjoyable parenting	Pretest-Posttest longitudinal design	78 mother-infant dyads in intervention group and 29 mother-infant dyads in control group. Mothers were at risk for neglect and abuse. Very young mothers. There was a major loss of data due to drop out and missing values	STEEP main goal besides keeping the baby safe was to support the development of secure infant-parent attachment by (1) enhancing maternal sensitivity by using video feedback (Seeing is believing), (2) addressing maternal attachment representations by encouraging mothers to explore past and current relationship experiences and their influence on parenting (looking back moving forward) (3) promoting the development of effective social support through bi-weekly individual visits and mother-child group experiences beginning during pregnancy till the child's second birthday	Two year intervention program

2.4 Categorization of included studies

2.4.1 Regarding RQ1

The ecological model of determinants of parenting of Belsky (1984) was used for the categorization of included studies. These three determinants were used for the categorization of contributing and impeding factors:

- (1) The individual mother and father, consisted of factors associated with the personality/behaviour of the mother and father. Furthermore, the developmental history, reproductive history and factors regarding the sociodemographic status were included in this determinant;
- (2) The characteristics of the infant, consisted of factors about the infant and the birth of the infant;
- (3) The contextual sources of stress and support for parents, consisted of factors associated with the social network, marital status and job of the parents.

With the use of these determinants, the contributing and impeding factors were categorized. They were also structured based on the time phase within the first 1001 critical days after conception. The time phase was prenatally indicated in trimesters (i.e. trimester 1 contains week 0-13, trimester 2 contains week 13-26 and trimester 3 contains week 25-40) and postnatally in months (month 1 to 24). The structuring was also based on the target group of every included study, because every included study focused on a specific group when identifying a certain factor (i.e. the mother or father or the parents).

2.4.2 Regarding RQ2

The identified factors that had a contributing or impeding effect on parental attachment were used to structure the intervention studies. The structuring was based on (a) the number of times one factor was addressed in an intervention study, (b) the time phase, which was indicated as prenatal (trimester 1, 2 and/or 3), prenatal and postnatal (trimester 1, 2 and/or 3 and month 1 to 24) and only the postnatal phase (month 1 to 24) and (c) on the target group, indicating that every intervention study focussed on a specific group when developing a certain intervention (i.e. the mother or the parents).

The ecological model of the determinants of parenting of Belsky (1984) was not used for the categorization of the intervention studies.

3. Results

3.1 Description of the studies identifying parental attachment

The first aim of this study was to identify contributing and impeding factors of secure parental attachment in the first 1001 critical days after conception in Western countries after 2010.

To answer this question, a total of 20 studies were included in the narrative analysis and these studies were published between 2010 and 2019. All the studies were published in peer-reviewed journals with an impact factor ranging from 4,418 and 1,247 as indicated by the SCIMAGOJR of 2018. The study designs were longitudinal (n=14) or cross-sectional (n=3) or correlational (n=3). One study consisted of a longitudinal and cross-sectional element. There was a wide range in the study samples, notably is that all study samples below 100 respondents were excluded in the present study. Eight studies had a study sample that consisted of 100-200 respondents, seven studies had a study sample that consisted of 201-400 respondents and five studies had a study sample of more than 400 respondents. The smallest study sample consisted of 102 respondents and the largest study sample consisted of 1454 respondents. The age range of mothers participating in the studies was between 16 and 46 years old. For fathers, the age range was between 20 and 51 years old. The study-populations were mostly non-risk populations (n=15) and five studies consisted of an at-risk population; two populations were related to preterm births, one population had an exposure to poverty and violence, one population consisted of mothers with child abuse histories and one population consisted of adolescent-mothers. The locations of where the studies were conducted had a wide range; six studies were conducted in Australia/New-Zealand, four studies were conducted in the USA/Canada and the majority of the studies were conducted in Western-Europe (n=10).

3.2 Categorization of the factors of parental attachment

The included studies were categorized, based on (1) The determinants of parenting, including the individual characteristics of the mother and father, the characteristics of the infant and the contextual sources of stress and support for the parents; (2) The time phase within the first 1001 critical days, including the prenatal period with trimesters (T2 and T3) and the postnatal phase with months (M1, M6 etc); (3) The target group, indicating that the studies focussed on a specific population when they identified a certain factor (i.e. mothers, fathers or the parents). Based on this, the

contributing and impeding factors of secure parental attachment could be categorized and they are presented by the first author of the study that identified the contributing or impeding factor.

Therefore, as represented in Table 5 and Table 6, the contributing and impeding factors of secure parental attachment are shown.

Table 5. *Contributing factors of secure parental attachment*

Determinant of parenting	Contributing factors	Target group	Time phase within 1001 critical days				
			Prenatal – Trimester 2	Prenatal - Trimester 3	Postnatal - Month 1	Postnatal - Month 6	Postnatal – Month 17
Individual characteristics of the mother and father	<i>Emotional well-being</i>	Father	Condon (2013)				
	<i>Experiential avoidance</i>	Mother					
	<i>Own childrearing history</i>	Parents	Hall (2015)				
	<i>Prenatal expectations</i>	Mother	Evans (2012)				
	<i>Balanced representations</i>	Father	Vreeswijk (2014)				
	<i>Planned pregnancy</i>	Mother	Camarneiro (2017)				
	<i>First pregnancy</i>	Father	Camarneiro (2017)				
		Mother	Camarneiro (2017)				
		Father	Vreeswijk (2014)				
	<i>Breastfeeding</i>	Mother	Tharner (2012)				
	<i>Age – Adults</i>	Mother	Rowe (2013)				
	<i>Age – Young mother</i>	Mother	Camarneiro (2017)				
	<i>Age – Young father</i>	Father	Camarneiro (2017)				
	<i>High SES</i>	Mother	Camarneiro (2017)				
		Father	Camarneiro (2017)				
	<i>High education</i>	Mother	Camarneiro (2017)				
Characteristics of the infant	<i>Few oxytocin alleles</i>	Mother	Ludmer (2018)				
	<i>Low cortisol output</i>	Mother	Ludmer (2018)				
	<i>Infant smiling</i>	Mother	Nolvi (2016)				
	<i>Preterm birth</i>	Mother	Hall (2015)				
Contextual sources of stress and support for parents	<i>Marital relationship</i>	Father	Condon (2013)				
	<i>Relationship own mother</i>	Mother	Tani (2018)				
	<i>Importance of fathering</i>	Father	Dayton (2019)				
	<i>Small family household</i>	Father	Camarneiro (2017)				
	<i>Instable job situation</i>	Father	Camarneiro (2017)				

Table 6. *Impeding factors of secure parental attachment*

Determinant of parenting	Impeding factors	Target group	Time phase within 1001 critical days				
			Prenatal – Trimester 2	Prenatal - Trimester 3	Postnatal - Month 6	Postnatal - Month 12	Postnatal – Month 17
Individual characteristics of the mother and father	<i>Depression</i>	Parents	Kerstis (2016)				
		Mother	Goecke (2012)				
		Father	Rossen (2016)				
	<i>Depressive rumination</i>	Mother	Vreeswijk (2014)				
		Father	Schmidt (2016)				
	<i>Anxiety</i>	Mother	Schmidt (2016)				
		Father	Vreeswijk (2014)				
	<i>Worrying</i>	Mother	Schmidt (2016)				
	<i>PTSD</i>	Mother	Dayton (2019)				
	<i>Child maltreatment history</i>	Mother	Dayton (2019)				
		Father	Dayton (2019)				
	<i>Disengaged representation</i>	Father	Vreeswijk (2014)				
	<i>Unplanned pregnancy</i>	Mother	Camarneiro (2017)				
		Father	Camarneiro (2017)				
	<i>Previous pregnancies</i>	Mother	Camarneiro (2017)				
		Father	Camarneiro (2017)				
	<i>Previous abortions</i>	Mother	Camarneiro (2017)				
	<i>Medical complications</i>	Mother	Camarneiro (2017)				
	<i>Bedsharing</i>	Mother	Mitchell (2015)				
	<i>Age – Adolescents</i>	Mother	Rowe (2013)				
	<i>Age – Older mothers</i>	Mother	Camarneiro (2017)				
	<i>Age – Older fathers</i>	Father	Camarneiro (2017)				
	<i>Low SES</i>	Mother	Camarneiro (2017)				
		Father	Camarneiro (2017)				
Characteristics of the infant	<i>Low education</i>	Mother	Camarneiro (2017)				
	<i>More oxytocin alleles</i>	Mother	Ludmer (2018)				
	<i>High cortisol output</i>	Mother	Ludmer (2018)				
	<i>Infant temperament</i>	Father	Condon (2013)				
Contextual sources of stress and support for parents	<i>Infant distress</i>	Mother	Nolvi (2016)				
	<i>Preterm birth</i>	Mother	Evans (2012)				
	<i>Parenting stress</i>	Mother	Rossen (2016)				
	<i>Stress - Assertiveness</i>	Father	Wynter (2016)				
	<i>Stress - Oversensitivity</i>	Father	Wynter (2016)				
	<i>Marital relationship</i>	Parents	Kerstis (2016)				
		Father	Wynter (2016)				
	<i>Big household size</i>	Father	Camarneiro (2017)				
	<i>Stable job situation</i>	Father	Camarneiro (2017)				

3.2.2 Identifying factors of secure parental attachment

According to Table 5, 22 contributing factors of secure parental attachment were identified by eleven different studies and in total by 27 studies. 19 studies (70%) identified factors during the prenatal phase (T2 and T3) and eight studies (30%) identified factors during the postnatal phase (M1, M6 and M17). Regarding the target group of included studies, 14 studies (56%) indicated factors for mothers, ten studies (40%) indicated factors for fathers and one study (4%) indicated factors for both parents.

According to Table 6, 28 impeding factors of secure parental attachment were identified by 17 different studies and in total by 46 studies. 23 studies (50%) identified factors during the prenatal phase (T2 and T3) and 23 (50%) studies identified factors during the postnatal phase (M6, M12 and M17). Regarding the target group of included studies, 20 studies (55%) indicated factors for mothers, 14 studies (39%) indicated factors for fathers and two studies (6%) indicated factors for parents. The identified factors are discussed below based on the determinants of parenting of Belsky (1984).

• Individual characteristics of the mother and father

All the contributing and impeding factors of parental attachment of the individual characteristics of the mother or father are schematically visualized in Figure 5. Clusters were made to divide factors that appear to be quite similar into contributing (upper + side) and impeding (lower – side) factors. This resulted in ten factors: (1) mental health; (2) childhood history; (3)

representation of an (unborn) infant; (4) planning of pregnancy; (5) number of pregnancies; (6) breastfeeding; (7) bedsharing; (8) age, (9) SES/education and (10) hormone composition. The formation of the ten factors is explained below.

(1) The first factor of this determinant was about the mental health state of the individual mother and father. It was found that a healthy emotional well-being had a contributing effect on parental attachment for fathers during the prenatal phase (T2), as well as no experiential avoidance for mothers during the postnatal phase (M17) (Condon, Corkindale, Boyce, & Gamble, 2013; Evans, Whittingham, & Boyd, 2012). When mothers had no experiential avoidance towards their infant, they were willing to experience emotions, memories, thoughts and bodily sensations. Impeding effects of parental attachment related to the mental health state of the individual mother or father also gained attention. In eight of the studies (47%), the focus was on depressive symptoms. Symptoms of depression or depressive rumination were assessed for both mothers and fathers during the prenatal phase (T2 and T3) and during the postnatal phase (M1 and M6) (Goecke et al., 2012; Kerstis et al., 2016; Muzik et al., 2013; Nolvi et al., 2016; Rossen et al., 2016; Schmidt, Seehagen, Vocks, Schneider, & Teismann, 2016; Vreeswijk, Maas, Rijk, & van Bakel, 2014; Wynter, Rowe, Tran, & Fisher, 2016). Another impeding effect concerning the mental health state of the individual mother and father was anxiety or worrying, which was assessed in five studies (30%). This was assessed for both mothers

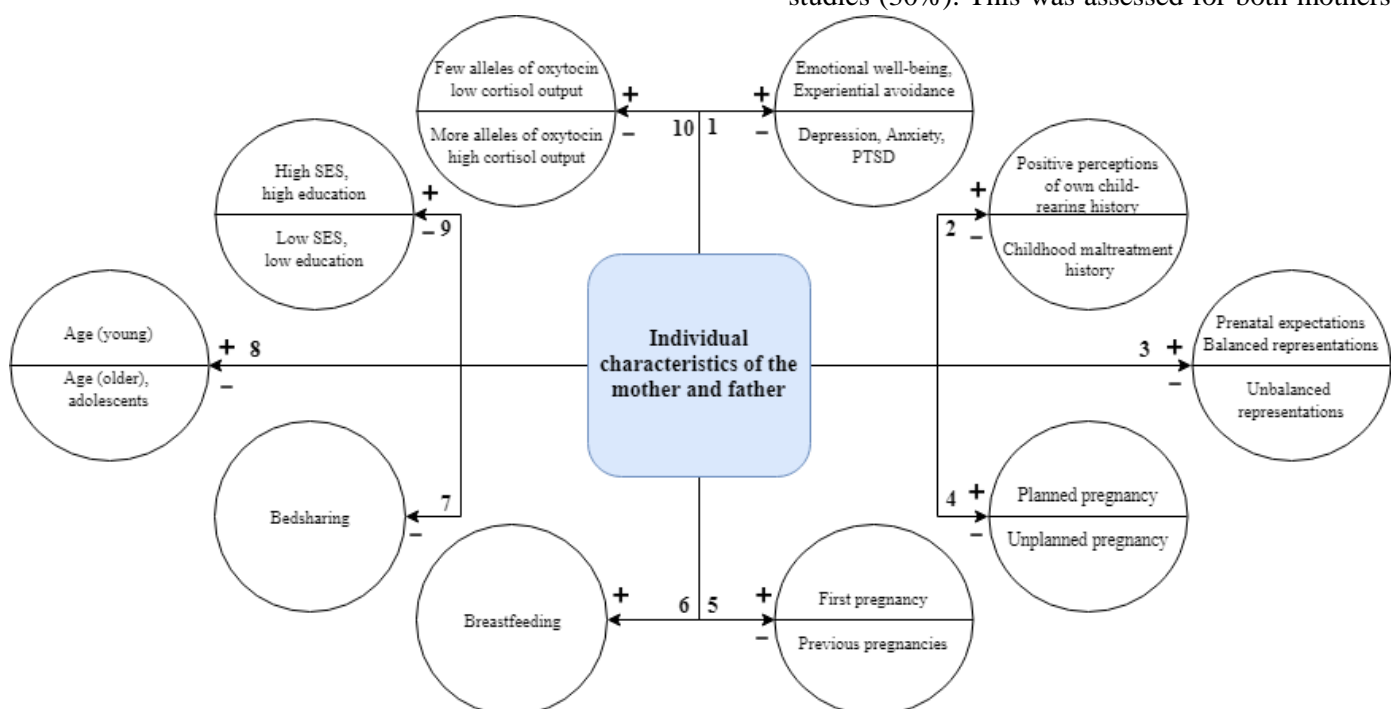


Figure 5. Contributing and impeding factors of parental attachment of the individual characteristics of the mother and father

and fathers during the prenatal (T2) and postnatal phase (M6) (Nolvi et al., 2016; Schmidt et al., 2016; Vreeswijk et al., 2014; Wynter et al., 2016). The last impeding effect associated with the mental health state of the mother was the development of a post-traumatic stress disorder (PTSD), which was assessed in three studies (18%). Symptoms of PTSD were assessed for mothers during the prenatal (T3) and postnatal phase (M6) (Dayton et al., 2019; Dekel, Thiel, Dishy, & Ashenfarb, 2019; Muzik et al., 2013).

Thus, the mental health state of the individual mother and father is an influential factor with contributing and impeding effects on parental attachment during the prenatal and postnatal phase.

- (2) The second factor was about the perceptions of the individual mother and father of their own childhood history. It was found that a positive childrearing history had a contributing effect on parental attachment for mothers and fathers in the postnatal phase (M1) (Hall et al., 2015). In contrast, a negative childrearing history, including a child maltreatment history had an impeding effect on parental attachment for mothers during postnatal phase (M6 and M17) and for fathers during the prenatal phase (T3) (Dayton et al., 2019; Ludmer et al., 2018; Muzik et al., 2013).

Perceptions of the own childhood history are thus an important factor of parental attachment for mothers during the postnatal phase and for fathers during the prenatal phase.

- (3) The third factor was about the representations and expectations of the individual mother and father towards an (unborn) infant. Positive prenatal expectations resulted in contributing mother-infant attachment assessed in the postnatal period (M17) (Evans et al., 2012). Similar occurred for fathers during the prenatal phase (T2), when fathers had a balanced representation of their (unborn) infant, this counted as a contributing effect on paternal-fetal attachment (Vreeswijk et al., 2014). An impeding effect was related to disengaged representations of the (unborn) infant. Fathers that had a disengaged representation of their (unborn) infant during the prenatal phase (T2) negatively affected the paternal-fetal attachment bond (Vreeswijk et al., 2014). This means that the representations and expectations of an (unborn) infant is an important factor of parental attachment for mothers during the postnatal phase and for fathers during the prenatal phase.

- (4) The fourth factor was about the planning of pregnancy or in other words the intention of becoming pregnant or not. When mothers and fathers decided to become parents, thus to become pregnant intentionally, this counted as a contributing effect on parental attachment (Camarneiro & de Miranda Justo, 2017). If the pregnancy was unplanned or in other words unintended or unwanted, this counted as an impeding effect on parental attachment (Camarneiro & de Miranda Justo, 2017).

Thus, the planning of pregnancy affects the quality of parental attachment of both mothers and fathers during the prenatal phase.

- (5) The fifth factor was related to the number of pregnancies. A contributing effect was found for becoming pregnant for the first time (first pregnancy), which was assessed for both mothers and fathers during the prenatal phase (T2) (Camarneiro & de Miranda Justo, 2017; Vreeswijk et al., 2014). An impeding effect was found for becoming pregnant for not the first time (previous pregnancies). Impeding effects that were related to a previous pregnancy were undergoing previous abortions (miscarriages) or undergoing medical complications during the previous pregnancy (Camarneiro & de Miranda Justo, 2017). This means that becoming parents for the first time results in a contributing effect on parental attachment, and in contrast, becoming parents for the second or third time has an impeding effect on parental attachment for both mothers and fathers during the prenatal phase.
- (6) The sixth factor was a contributing factor concerning the breastfeeding initiation. When infants were breastfed for a long period (over six months) it had a contributing effect on parental attachment for mothers and this was visible during the postnatal phase (M17) (Tharner et al., 2012). This means that the duration of breastfed infants contribute towards parental attachment assessed in mothers during the postnatal phase.
- (7) The seventh factor was an impeding factor about the bedsharing habits of mothers with their infant. When mothers shared the bed with the infant, it had an impeding effect on parental attachment during the postnatal phase (M6) (Mitchell, Hutchison, Thompson, & Woudes, 2015). This means that mother-infant bedsharing negatively influences parental attachment.

- (8) The eighth factor was about the age of the parents. On the one hand, it was found that adults (18+) or more specifically young mothers (18+) and young fathers (18+) contribute to parental attachment during the prenatal phase (T2 and T3) (Camarneiro & de Miranda Justo, 2017; Rowe, Wynter, Steele, Fisher, & Quinlivan, 2013; Vreeswijk et al., 2014). On the other hand, it was found that the function of age impedes parental attachment. Adolescents (younger than 18 years old), older mothers (30+) and older fathers (40+) impede parental attachment during the prenatal phase (T2 and T3) (Camarneiro & de Miranda Justo, 2017; Rowe et al., 2013). This means that the age of both mothers and fathers has a contributing and impeding effect on secure parental attachment in the prenatal phase.
- (9) The ninth factor was about the socio-economic status (SES) and education of the individual mother and father. A high SES and high level of education had a contributing effect on parental attachment assessed in mothers and fathers during the prenatal phase (T2) (Camarneiro & de Miranda Justo, 2017). In contrast, a low SES and a low educational level had an impeding effect on parental attachment assessed in mothers and fathers during the prenatal phase (T2) (Camarneiro & de Miranda Justo, 2017). This means that the SES and educational level is an important factor of secure parental attachment for both mothers and father in the prenatal phase.
- (10) The last factor was about the hormone composition of the individual mother during the postnatal phase (M17). It was assessed that having few plasticity alleles of oxytocin (OXTR) and a low cortisol output had a contributing effect on parental attachment and more plasticity alleles of oxytocin and a high cortisol output had an impeding effect on parental attachment (Ludmer et al., 2018).

Thus, the composition of hormones, such as oxytocin and cortisol, is a factor that contributes or impedes parental attachment for mothers during the postnatal phase.

- Characteristics of the infant

The contributing and impeding factors of the characteristics of the infant and the infant's birth are discussed below and represented in Figure 6. The factors that fitted this determinant are (1) infant temperament and (2) preterm birth.

- (1) The first factor within this determinant was infant temperament. It was found that infant smiling or

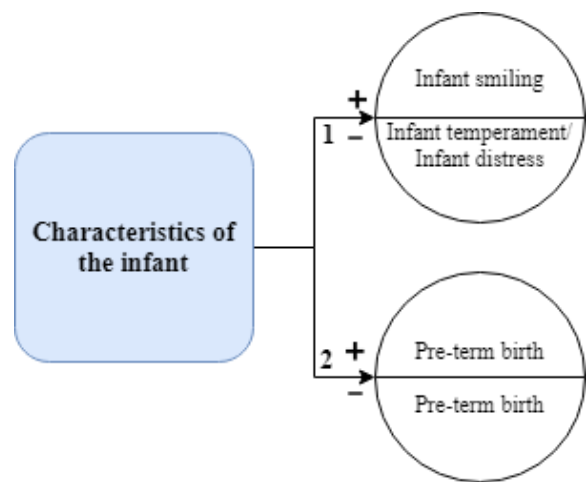


Figure 6. Contributing and impeding factors of parental attachment of the characteristics of the infant

positive emotionality of the infant reported by the mother had a contributing effect on parental attachment, which was assessed in mothers during the postnatal phase (M6) (Nolvi et al., 2016). In contrast, negative emotionality of the infant (negative infant temperament) resulted in infant distress and this had an impeding effect on parental attachment for mothers and fathers during the postnatal phase (M1 and M6) (Condon et al., 2013; Nolvi et al., 2016).

Overall, the temperament of the infant was an important factor that affects the level of parental attachment for mothers and fathers during the postnatal phase.

- (2) The second factor is about the birth of the infant. When infants were born too early, this is called a preterm birth. A preterm born infant had on the one hand a contributing effect for mothers during the postnatal phase (M17) and on the other hand had an impeding effect for mothers during the postnatal phase (M1) (Evans et al., 2012; Hall et al., 2015).

However, this is the only factor that has the same contributing and impeding effects on parental attachment for mothers during the postnatal phase.

- Contextual sources of stress and support for the parents

The associated factors of the contextual sources of stress and support for parents were about the social network, marital status and job of the parents. The contributing and impeding factors showed similarities and these are visualized in Figure 7. The factors that fitted this determinant are (1) the marital relationship; (2) parenting stress; (3) household size and (4) job situation.

- (1) The first factor within this determinant was about the marital status, which had a contributing and

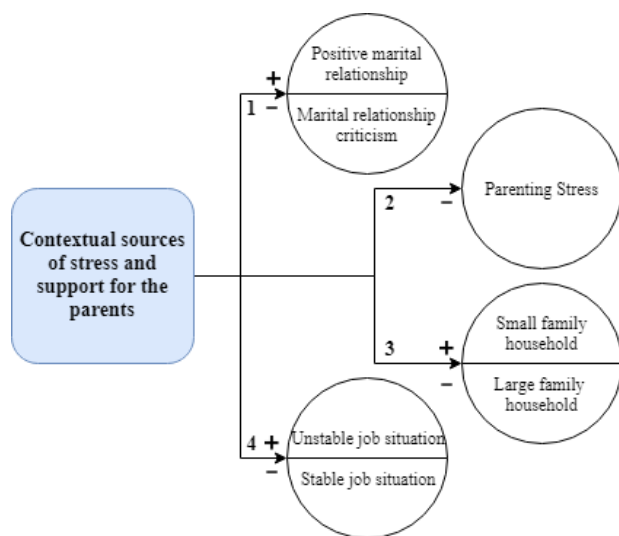


Figure 7. Contributing and impeding factors of parental attachment of the contextual sources of stress and support for the parents

impeding effect on parental attachment. A good marital relationship had a contributing effect on parental attachment for fathers during the prenatal phase (T2) (Condon et al., 2013). Marital relationship criticism was found to be negatively affecting parental attachment, which was assessed in parents during the postnatal phase (M6) (Kerstis et al., 2016; Wynter et al., 2016).

In short, support of the other partner is important for developing an attachment bond between parents and the infant during the prenatal and postnatal phase. Additionally, the relationship of mothers with their own mother also had a contributing effect on parental attachment. It was found that mothers who have a positive relationship with their own mother developed a secure attachment bond with their fetus during the prenatal phase (T3) (Tani, Castagna, & Ponti, 2018). Therefore, the relationship with the own mother is integrated in the factor of marital relationship.

- (2) The second factor was related to contextual sources of stress and identified as parenting stress. It was found that parenting stress had an impeding effect on parental attachment assessed in mothers during the prenatal and postnatal phase (T2 and M12) (Moe, Von Soest, Fredriksen, Olafsen, & Smith, 2018; Rossen et al., 2016). Parenting stress was also assessed in fathers during the postnatal phase (M6), but this was mostly related to stress about the opinion of others and lack of assertiveness (Wynter et al., 2016). Parenting stress about the care of the infant is thus for both mothers and fathers an impeding factor of parental attachment during the prenatal and postnatal phase. However, it was observed that when fathers understand the importance of fathering during the prenatal phase (T3), it would be a precursor of developing no parenting stress (Dayton et al., 2019). This effect is

related to parenting stress and is therefore integrated in the factor of parenting stress.

- (3) The third factor was about the household size. A small household size had a contributing effect on parental attachment for fathers in the prenatal phase and a large household size had an impeding effect on parental attachment for fathers in the prenatal phase (Camarneiro & de Miranda Justo, 2017).

Therefore, the size of the household, or living with a substantial number of people, affects the attachment bond between fathers and their fetus during the prenatal phase.

- (4) The last factor was about the job situation of parents, which had a contributing and impeding effect on parental attachment. An unstable job situation contributed to parental attachment assessed in fathers during the prenatal phase (T2) (Camarneiro & de Miranda Justo, 2017). In contrast, having a stable job situation impeded parental attachment assessed in fathers during the prenatal phase (T2) (Camarneiro & de Miranda Justo, 2017). This means that the formation of an attachment bond between fathers and fetus is dependent of the job situation of the father.

3.2.2 Identified factors of secure parental attachment

The first research question of this study was: *which factors contribute and impede a secure parental attachment in the first 1001 critical days after conception in Western countries after 2010?*

In this first part of the mini-review, a total of 16 identified factors were found in 20 included studies. These identified factors were: mental health, childhood history, representation of an (unborn) infant, planning of pregnancy, number of pregnancies, breastfeeding, bedsharing, age, SES/education, hormone composition, infant temperament, preterm birth, marital relationship, parenting stress, household size and job situation.

Most of the factors had a contributing and impeding effect (81%), two factors only had an impeding effect (13%) and one factor only had a contributing effect (6%). The included studies focussed on a specific target group; six factors focussed on both parents (38%), twelve factors focussed on only mothers (75%) and six factors focussed on only fathers (44%). For mothers, all the 16 factors were present in a particular time phase (100%) and for fathers, 13 factors were present in a particular time phase (81%). Ten of the 16 factors (62,5%) were present during the 2th trimester of the prenatal phase, five factors (31,3%) were present during the 3th trimester of the prenatal

phase. During the postnatal phase, in the first month and in the twelfth month, two factors (12,5%) were present; at six months were five factors (31,3%) present and at 17 months there were six factors (37,5%) present.

In Table 7, all the 16 identified factors are presented based on the effect on parental attachment, the time phase and the target group. Some factors are

Table 7. All the identified factors of parental attachment

Effect on parental attachment	Target group	Prenatal (T2)	Prenatal (T3)	Postnatal (M1)	Postnatal (M6)	Postnatal (M12)	Postnatal (M17)
Contributing and impeding	Parents	Age Mental health Number of pregnancies Planning of pregnancies SES/Education	Age Mental health	Childhood history	Mental health		
	Mothers		Marital relationship	Preterm birth	Childhood history	Infant temperament	Childhood history Hormone composition Mental health Preterm birth Representation of unborn child
	Fathers	Household size Job situation Marital relationship Representation of an (unborn) infant	Childhood history Representation of an (unborn) infant		Infant temperament		
Impeding	Mothers	Parenting stress			Bedsharing	Parenting stress	
	Fathers	Parenting stress					
Contributing	Mothers						Breastfeeding
Number of factors		N=10	N=5	N=2	N=5	N=2	N=6

mentioned twice in Table 7 and this means that one factor is present in more time phases, for instance mental health is a factor in more time phases. When a factor was present for mothers and fathers and in the same time phase, this factor was put in the target group consisting 'parents'.

3.3 Description of included intervention studies

The second aim of this study was to determine if current preventive interventions use the previously identified factors to ensure secure parental attachment in Western countries after 2010?

To answer this question, a total of 13 studies were included in the narrative analysis and these studies were published between 1999 and 2018. All the studies were published in peer-reviewed journals with an impact factor ranging from 5,014 and 0,629 as indicated by the SCIMAGOJR of 2018.

The intervention studies could be divided in four different study designs. Four studies explained the protocol for a randomized controlled trial (RCT) that was going to be performed, three studies had a study design of a RCT, three studies were a non-randomized controlled trial (based on locality/time/gestational age) and three studies had a longitudinal pre-test/post-test study design. The study samples consisted mostly of mother-infant dyads (n=12) and one study sample consisted of (expectant) mothers. The largest sample

size consisted of 110 couples (220 mothers and fathers) and the smallest sample size consisted of 24 mothers.

Regarding to the study populations, three study populations were not at-risk. The majority of the study populations were at-risk (n=10). The study populations that consisted of an at-risk group contained multiple elements of the following randomly ordered risks: living in social isolation, low family support, father in prison, intimate partner violence, substance misuse, maternal stress or mental health problems (such as a depression), current involvement with social services, abnormal reaction to pregnancy (unplanned pregnancy), first-time parent, low SES/education, less than 25 years of age, parenting alone, lacks of confidence or self-efficacy, at risk for poor infant sensitivity, low relationship satisfaction, low life satisfaction/happiness.

The locations of where the studies were conducted had a wide range; three studies were conducted in Australia, four studies were conducted in the USA/Canada and the majority of the studies were conducted in Western-Europe (n=6).

3.4 Categorization of included intervention studies of parental attachment

The included intervention studies were categorized based on; (1) The previously identified 16 contributing or impeding factors, which were structured on the number or times found in the intervention studies; (2) The time phase within the first 1001 critical days,

divided into three phases (i.e. the prenatal phase, prenatal and postnatal phase and the postnatal phase); (3) The target group, indicating on which specific group the intervention focussed. In this case, the intervention studies focussed on both parents or the mother. Based on this, the intervention studies were categorized and they are presented by the first author of the study in Table 8.

Table 8. Categorization of the intervention studies

Factor of parental attachment	Target group	Time phase in 1001 critical days		
		Prenatal	Prenatal and Postnatal	Postnatal
Infant temperament (n=13)	For parents		Erickson and Egeland (2004) Mihelic et al. (2018)	Blizzard et al. (2018) Hoffman et al. (2006) O'Neill et al. (2018) Sanders (1999) Vaever et al. (2016) Svanberg et al. (2010)
	For mothers	Thomas et al. (2014)	MacDonald et al. (2018) Torres et al. (2011)	Ramsauer et al. (2014) Suess et al. (2016)
Marital relationship (n=6)	For parents		Erickson and Egeland (2004) Mihelic et al. (2018)	Sanders (1999)
	For mothers	Thomas et al. (2014)	Torres et al. (2011)	Suess et al. (2016)
Mental health (n=6)	For parents		Mihelic et al. (2018)	Sanders (1999) Svanberg et al. (2010)
	For mothers	Thomas et al. (2014)	MacDonald et al. (2018) Torres et al. (2018)	
Childhood history (n=5)	For parents		Erickson and Egeland (2004)	Hoffman et al. (2006) Svanberg et al. (2010)
	For mothers		Torres et al. (2011)	Suess et al. (2016)
Representation of an (unborn) infant (n=5)	For parents		Mihelic et al. (2018)	Hoffman et al. (2006) Sanders (1999)
	For mothers		MacDonald et al. (2018) Torres et al. (2011)	
Parenting stress (n=3)	For parents			Sanders (1999) Svanberg et al. (2010)
	For mothers		MacDonald et al. (2018)	
Age (n=1)	For mothers			Suess et al. (2016)
Bedsharing (n=1)	For parents			Sanders (1999)
Breastfeeding (n=1)	For mothers		MacDonald et al. (2018)	
Planning of pregnancy (n=1)	For mothers		MacDonald et al. (2018)	
Preterm birth (n=1)	For mothers		MacDonald et al. (2018)	

3.4.1 Intervention studies that used the contributing or impeding factors to ensure parental attachment

Of the 16 previously identified factors of parental attachment, 11 factors (68,8%) were present in one or more intervention studies. Five factors (31,2%) were not present in the intervention studies and these factors were the number of pregnancies, SES/education, hormone composition, household size and job situation. Regarding the time phase within the 1001 critical days, three of the 16 factors (18,8%) were addressed in the prenatal phase by only one study, nine factors (56,3%) were addressed in the prenatal and postnatal phase by four different studies and eight factors (50%) were addressed in the postnatal phase by eight different

studies. Most of the factors that were addressed in the intervention studies consisted of a target group focussed on mothers and parents (n=6), four factors were addressed in the intervention studies with a target group focussed on mothers and one factor focussed on both parents. The factors that were present in the intervention studies are discussed below based on the number of times found in the intervention studies.

- Infant temperament (n=13)

This factor was present in all the intervention studies (100%) and also present in all the time phases.

During the prenatal phase, infant temperament was a component of the antenatal group program of Thomas, Komiti, and Judd (2014). They have indicated

that prior to birth, mothers should acknowledge that being sensitive and responsive to their infant automatically influence the development of sensitive and responsive early parent-infant interactions, which influences the temperament of the infant.

During the prenatal and postnatal phase, infant temperament was a component in four intervention studies. First, regarding the parents, keeping track on the infants' behaviour, responding to your infant and information about infants' crying is prenatally and postnatally addressed in the Baby Triple P intervention of Mihelic, Morawska, and Filus (2018). Second, the Steps Towards Effective and Enjoyable Parenting (STEEP) intervention of Erickson and Egeland (2004), they want to improve parental knowledge and assist by understanding the infants' behaviour. The STEEP intervention focusses on improving parental sensitivity and responsiveness to infant cues. Third, in the New Baby Programme of Macdonald et al. (2018), the intervention addresses the importance of sensitive and responsive parenting and they assist, advise and support mothers in the management of the infants' behaviour. Last, in the Spanish group intervention of Torres, Alonso-Arbiol, Cantero, and Abubakar (2011), they prenatally address the importance of the developmental tasks in the first year of the infants' life and postnatally address the main developmental tasks again as well as focussing on sensations and needs, feelings and representations of the mother towards the infant.

During the postnatal phase, infant temperament was a component in eight intervention studies. First, regarding the parents, the Infant Behaviour Program (IBP) of Blizzard, Barroso, Ramos, Graziano, and Bagner (2018), addresses the parenting do and don't skills, based on PRIDE (i.e. Praising the infant, Reflecting the infant's speech, Imitating the infant's play, Describing the infant's behaviour and Enjoyment in the play) which influence the infants' temperament. Second, the Circle of Security (COS) intervention of Hoffman et al. (2006), addresses the importance of sensitive and responsive caregiving in relation to understanding the infants' cues and behaviour, which influences the infants' temperament during a group based intervention for a broader age group of children (0-52 months). Third, the Circle of Security Parenting (COS-P) intervention of Væver, Smith-Nielsen, and Lange (2016) was the short adjusted version of the regular COS, and is especially designed for promoting parent-infant attachment, for a smaller group of children (infants aged 2-12 months). Forth, another adjusted COS was established by Ramsauer et al. (2014) and this

adjusted version is aimed especially for mentally ill mothers and their infants (aged 4-9 months). Fifth, the Make the Connection (MTC) intervention of O'Neill, Swigger, and Kuhlmeier (2018), addresses the parental attitudes to enhance the parent's ability to take the infants' perspective and understand infant communication, with the ultimate goal of establishing felt security for the infant. Sixth, the Triple P intervention of Sanders (1999), this intervention has five levels which all try to address the importance of sensitive and responsive caregiving and understanding infant cues, for example in level 1 of the intervention, a media campaign should promote positive parenting. Seventh, the Sunderland Infant Programme of Svanberg, Menner, and Spieker (2010), in this intervention infant temperament is addressed through improved reading and responding to infant cues and by increasing the parents' understanding of the infants' behaviour.

The interventions especially created for mothers were of Ramsauer et al. (2014) (listed as fourth) and lastly of Suess, Bohlen, Carlson, Spangler, and Frumentia Maier (2016), who updated the earlier STEEP intervention of Erickson and Egeland (2004), but focusses only on the postnatal phase, which is about the acknowledgement of enhanced maternal sensitivity with the use of videotaping.

- Marital relationship (n=6)

Six intervention studies (46%) focussed on strengthening the marital relationship and this factor was present in all time phases.

During the prenatal phase, the antenatal group program of Thomas et al. (2014) contains the component of interpersonal therapy addressing the couple's communication, role transition and awareness between the couple of each other's mental health warnings, which belongs to the importance of the marital relationship.

During the prenatal and postnatal phase, the marital relationship was a component in three intervention studies. In the STEEP intervention of Erickson and Egeland (2004) the parent's reflective capacity is addressed, mainly about how the relationship of parents influence the responses to their infant. In Baby Triple-P of Mihelic et al. (2018) the support of the partner is addressed which consists of communication skills between couples and tips to stay happy in your relationship. In the Spanish group intervention of Torres et al. (2011) there is a prenatal session for mothers which addresses the importance of the partner in the

new family structure and the role.

During the postnatal phase, the marital relationship was a component in two intervention studies. In the Triple-P intervention of Sanders (1999), the support of the partner is addressed, because parents are assisted in improving their communication skills and provide each other support for their parenting efforts. In the updated STEEP intervention of Suess et al. (2016) the promotion of effective social support of partners is addressed.

- Mental health (n=6)

Six intervention studies (46%) focussed on strengthening mental health and this factor was present in all time phases.

During the prenatal phase, the component was addressed in the antenatal group program of Thomas et al. (2014). Mental health is addressed as a psycho-educational component focusing on mood monitoring, early detection and contingency planning for emerging anxiety and depression in the prenatal and in the postnatal phase.

During the prenatal and postnatal phase, three studies addressed the component of mental health. In the Baby Triple-P intervention of Mihelic et al. (2018), unpleasant emotions are identified which addresses the importance of a positive mental health state. In the New Baby Programme of Macdonald et al. (2018) the importance of good physical and mental health for mothers is explained during house visits of professionals. In the Spanish group intervention of Torres et al. (2011), parents' mental representations of him/herself as a mother are addressed.

During the postnatal phase, two intervention studies addressed the component of mental health. In the Triple-P intervention of Sanders (1999), the coping skills of parents are addressed for parents who experienced personal adjustment difficulties such as depressions, anxiety, anger or stress. In the Sunderland Infant Programme of Svanberg et al. (2010), parent-infant psychotherapy is offered when the parents' own psychopathology jeopardizes the ability to care for the infant.

- Childhood history (n=5)

Five intervention studies (38%) focussed on the own childhood history and this factor was present in two time phases.

During the prenatal and postnatal phase, the component was addressed in the STEEP intervention of

Erickson and Egeland (2004) in which parents are asked to review their own childhood history and explain how this could affect their caregiving behaviour. For mothers, this component was addressed in the Spanish group intervention of Torres et al. (2011) which addresses the relevance of the own childrearing experience with the own parents.

During the postnatal phase, the component was addressed in the COS intervention of Hoffman et al. (2006) who stated that the reflection of parents' own developmental childhood history may have influenced their own current caregiving behaviour. This is also the case in the Sunderland Infant Programme of Svanberg et al. (2010), which focuses on the links from the mother's own childhood experience to her current parenting behaviour. Lastly, the updated STEEP intervention of Suess et al. (2016) is encouraging mothers to explore current and past experiences and explain how this influences their parenting behaviour.

- Representations of an (unborn) infant (n=5)

Five intervention studies (38%) focussed on strengthening the representations of an (unborn) infant and this factor was present in two time phases. During the prenatal and postnatal phase, the component was addressed by the Baby Triple-P intervention of Mihelic et al. (2018), which contains a session related to individual survival skills, in which the expectations of becoming parents are addressed. Also in the New Baby Programme of Macdonald et al. (2018), the mother receives age appropriate information and advice on the infants' nutrition, health, growth and development and information about how to prepare themselves for the upcoming birth and the early parenthood. In the Spanish group intervention of Torres et al. (2011), the parents' representations of an future infant are addressed.

During the postnatal phase, the COS intervention of Hoffman et al. (2006) addresses the empathy of parents to their infant related to the expectations of being a sensitive parent. The Triple-P intervention of Sanders (1999) addressed this component based on the representation of being a parent and the expectations that their representation affects the infants' behaviour.

- Parenting stress (n=3)

Three intervention studies (23%) focussed on reducing parenting stress and this factor was present in two time phases. During the prenatal and postnatal phase, the New Baby Programme of Macdonald et al. (2018) screened mothers for domestic violence and other

sources of prenatal stress and they discuss alternative strategies to deal with stress and empower the mother to take appropriate action to reduce the parenting stress.

During the postnatal phase, the Triple-P intervention of Sanders (1999) consists of a component related to assisting parents by identifying dysfunctional thinking patterns. They introduce parents to personal coping skills such as relaxations, stress inoculation training, challenging unhelpful thoughts and developing coping plans. In the Sunderland Infant Program of Svanberg et al. (2010), parenting stress is addressed for the early identification of dysfunctional parenting characteristics.

- Five factors were mentioned once in an intervention study

The following factors were addressed once in an intervention study: age, bedsharing, breastfeeding, planning of pregnancy and preterm birth. First, the factor age was addressed in the updated STEEP intervention of Suess et al. (2016), because in this intervention the population consists of adolescents (48,7% of the mothers were younger than 18 years), the STEEP intervention is especially designed for a younger age group, with age-appropriate information. Second, the bedsharing experiences were addressed in the Triple-P intervention of Sanders (1999), in which they assist parents with bedtime difficulties. The factors of breastfeeding, planning of pregnancy and preterm birth were all addressed in the New Baby Programme of Macdonald et al. (2018). The factor of breastfeeding is addressed during the postnatal phase in which healthcare professionals assist mothers in establishing feeding practices and encourage breastfeeding. Planning of pregnancy is prenatally addressed by the healthcare professional, because they discuss the family planning and birth control after the delivery of the newborn. Preterm birth is associated with a main outcome of the intervention whereas regular monitoring of the health of the mother and infant leads to a full term born infant and reduces the admission to the Neonatal Intensive Care (NIC).

3.5 Intervention studies that used the factors of secure parental attachment

The second research question of this study was: *which current preventive interventions use these contributing or impeding factors to ensure a secure parental attachment during the first 1001 critical days after conception in Western countries after 2010?*

In the second part of this mini-review 13 intervention studies were included in the analysis. In total, these preventive evidence-based interventions used 11 of these previously identified contributing and impeding factors to ensure secure parental attachment. Of these 11 factors, only one factor, infant temperament, was addressed in every intervention study (n=13), four factors were addressed in five or six intervention studies (marital status, mental health, childhood history and representation of the (unborn) infant), one factor, parenting stress, was addressed in three intervention studies and five factors were addressed in only one intervention study (age, planning of pregnancy, bedsharing, breastfeeding and preterm birth). Five identified factors did not fit one intervention study and these were the number of pregnancies, SES/education, hormone composition, household size and job situation.

4. Discussion/Conclusion

The research questions of the present study were (1) to identify contributing and impeding factors of secure parental attachment in the first 1001 critical days after conception in Western countries after 2010 and (2) to determine which current preventive evidence-based interventions use these factors to ensure secure parental attachment in the first 1001 critical days after conception in Western countries after 2010.

The findings of the present study provide direction for child healthcare professionals and future research in evidence-based healthcare. In total, 16 factors of secure parental attachment were identified and 11 of these factors were used in current preventive evidence-based interventions to ensure secure parental attachment. The identified factors of parental attachment were compared with the interventions to ensure secure parental attachment and it was not expected that current preventive evidence-based interventions of parental attachment addressed only a few of the identified factors of parental attachment. Only one factor was addressed in all the intervention studies and four factors were addressed in six intervention studies (46%). This means that not all the identified factors of parental attachment have been taken into account in the intervention studies. Thus, there is a discrepancy between the findings of this review and the factors of importance within the intervention studies. Possible reasons of this discrepancy are explained later. Besides, as presented in Table 9, a comparison of the identified factors of parental attachment and the intervention studies revealed some additional notable scores.

Table 9. Comparison of the findings of the identified factors of parental attachment and the intervention studies

Comparison	Findings of identified factors of parental attachment						Findings of intervention studies of parental attachment					
Factors of parental attachment	Prenatal			Postnatal			Prenatal		Prenatal and Postnatal		Postnatal	
	P	M	F	P	M	F	P	M	P	M	P	M
<i>Mental health</i>	X*			X*			X		X	X	X	
<i>Childhood history</i>			X	X*					X	X	X	X
<i>Representation of (unborn) infant</i>			X		X				X	X	X	
<i>Planning of pregnancy</i>	X*								X			
<i>Number of pregnancies</i>	X*											
<i>Age</i>	X*											X
<i>SES/Education</i>	X*											
<i>Hormone composition</i>					X							
<i>Infant temperament</i>					X	X	X	X	X	X	X	X
<i>Breastfeeding</i>					X				X			
<i>Bedsharing</i>					X						X	
<i>Preterm birth</i>					X				X			
<i>Marital relationship</i>		X	X				X	X	X	X	X	X
<i>Parenting stress</i>		X			X	X			X		X	
<i>Household size</i>			X									
<i>Job situation</i>			X									

*: Indicates that the factor was present for both parents, thus for mothers and fathers

First, there was a notable difference in the target groups of the included studies of parental attachment and included intervention studies. In the studies about factors of parental attachment, there were three target groups (i.e. the mother, the father or both parents), but in the intervention studies, the target group containing fathers disappeared. This means that there was no intervention that consisted of a target group of only fathers. This was unexpected, because multiple studies that identified factors of parental attachment used a target group focussed on only fathers. This means that there is a current knowledge gap about preventive paternal attachment interventions, which are aimed at fathers only.

Second, there was a notable difference in the factors of parental attachment that were identified in several different time phases. For instance, 'infant temperament' was a factor found in the postnatal phase in findings of factors of parental attachment, but was a factor in all the time phases in the findings of intervention studies. The same can be said about the 'marital relationship', which was a factor found in the prenatal phase in the findings of factors of parental attachment, but was a factor in all the time phases in the findings of the intervention studies. This means that the intervention studies used the identified factors of parental attachment in a broader time phase. However, this was unexpected, but explainable since the present study included studies starting from 2010 and it was acknowledged that academic literature about parental

attachment in general was growing in the last decade (Brandon, Pitts, Denton, Stringer, & Evans, 2009).

Third, a notable similarity was observed in the factor of 'mental health'. This factor was observed in every time phase in the findings of factors of parental attachment and was also observed in every time phase in the findings of intervention studies. This similarity was expected, because this factor was found in multiple studies identifying factors of parental attachment and it was expected that intervention studies would use the mostly identified factor of mental health in their intervention to ensure secure parental attachment.

Moreover, the comparisons of the findings of factors of parental attachment and the findings of intervention studies provide thus direction for child healthcare since the identified factors of parental attachment were not that much addressed in intervention studies to ensure secure parental attachment. Therefore, the individual contributing and impeding factors of parental attachment were analysed in relation to the intervention studies. The five most identified factors (mental health, childhood history, representations of an (unborn) infant, infant temperament and marital relationship) were analysed based on the determinants of parenting to explain the perceived discrepancy in the comparison of the findings of factors of parental attachment and the findings of the intervention studies.

4.1 Discrepancies in the comparison of factors of parental attachment and the intervention studies

In the present study, it was unexpected that only six out of 13 studies (46%) addressed the factor of mental health explicitly in their intervention study. Especially because ten of the 13 interventions consisted of an at-risk population consisting of mental health problems. In the meta-analytic study of Gavin et al. (2005), it was found that the development of mental health problems during the prenatal and postnatal phase affected almost 20% of the childbearing mothers living in developed countries. This indicates that due to the high prevalence of mental health problems, it is recommended that interventions address the mental health state of mothers (and fathers) during the first 1001 critical days after conception, because poor outcomes of suffering from a depression could affect the parent-infant attachment bond. In a recent study of van der Zee-van den Berg et al. (2017), evidence was found that screening for a postnatal depression in well-child care (WCC, in which child healthcare professionals have frequent contact with mothers during the entire postnatal year) improved overall maternal health and reduced the negative effects on infant development. van der Zee-van den Berg et al. (2017) argued that the Edinburgh Postnatal Depression Scale (EPDS) need to be implemented as a three-time assessment in preventive interventions in routine care in the Netherlands with the aim to improve maternal health and parenting. Thus, the factor of mental health is irrevocably linked to improved maternal outcomes which includes the attachment behaviour of mothers towards their infant.

Besides, parents who experienced a negative childrearing history (including child maltreatment or abuse) also negatively affected the parent-infant attachment bond. In a recent study of Assink et al. (2018), evidence was found that in families of parents who experienced child maltreatment or abuse in their own childrearing history, the odds of child maltreatment to their own children is almost three times the odds of child maltreatment in families of parents without a history of experiencing a negative childrearing history. This means that there is an intergenerational transmission of child maltreatment, which could potentially affect the parent-infant attachment bond. Also, evidence was found that parents with insecure attachment styles were distancing themselves emotionally from childhood experiences, which could eventually lead to mental health problems such as PTSD (R. Muller, Sicoli, & Lemieux, 2000; Roisman, Tsai, &

Chiang, 2004). In the present study, five intervention studies addressed the factor of parents' own experiences of their childhood history and two of the five interventions also addressed mental health problems in their intervention. The same can be said about the factor related to the representations of an (unborn) infant. This factor was addressed in five intervention studies and all of these five intervention studies addressed the factor of mental health problems or the own childhood history. Moreover, unexpectedly, associations between the mental health state of parents, the parents' own childhood experiences and their representations of an (unborn) infant were found (Dayton, Levendosky, Davidson, & Bogat, 2010; Van IJzendoorn, 1995). This means that these three factors are all interrelated within this determinant of parenting. Therefore, it is recommended that these three factors are addressed in interventions to ensure parental attachment in the first 1001 critical days after conception, see Figure 8.

The most addressed factor in the determinant of the characteristics of the infant was infant temperament. This factor was addressed based on the attachment theory of Bowlby (1969) who stated that attachment is as a reciprocal behavioural process initiated by the infant to secure proximity to the parent. As expected, all the included interventions (100%) focused on the parents' behaviour towards their infant, which influences the temperament of the infant. It was expected that when parents understood the infants' cues and behaviour, it automatically improves the parent-infant attachment bond. Moreover, infants cannot express their feelings verbally, because they cannot speak. Thus, it is understandable that parents have to be guided in understanding the infants' behaviour by child healthcare professionals, what was done in all the included intervention studies.

The last factor was addressed in six intervention studies and relates to the contextual sources of stress and support for parents. The marital relationship was characterized as a factor of parental attachment. However, it was unexpected that interventions were addressing this factor, because parents cannot be forced to stay in a healthy marital relationship. Although, this factor is a good example of a preventive aspect of an intervention, because marital criticism was addressed by for instance suggesting communicating skills and supporting each other in being a sensitive parent. This could potentially contribute to secure parental attachment in the first 1001 critical days after conception.

Overall, with the use of the determinants of parenting, the mostly addressed factor of each determinant was explained and represented in Figure 8. Although, it must be noted that three factors within the individual characteristics of the mother and father are interrelated and must be combined in every newly developed intervention study or in every improved and adjusted intervention study. This leads to the acknowledgement that preventive evidence-based interventions to ensure secure parental attachment in the first 1001 critical days after conception in Western countries after 2010 should use at least these (interrelated) factors based on the three determinants of parenting of Belsky (1984).

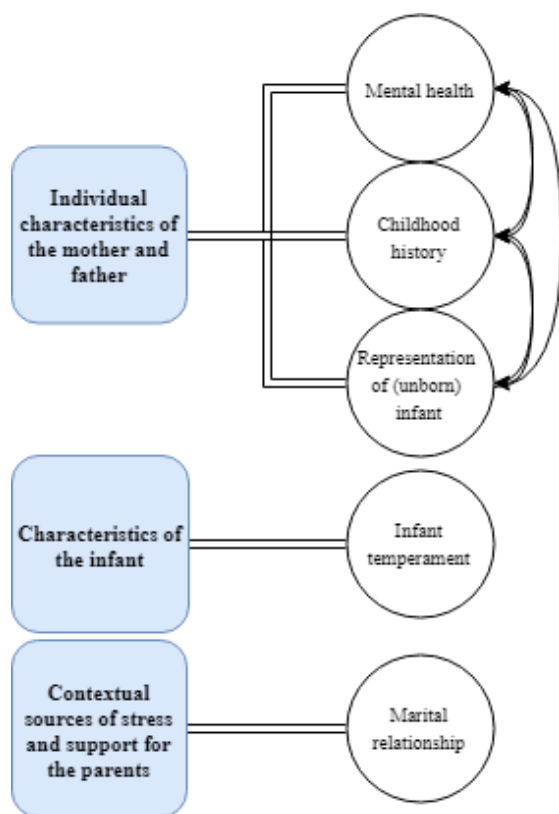


Figure 8. *Most addressed factors of each determinant of parenting*

The other identified factors were not much addressed in the intervention studies. Factors related to the reproductive history (planning of pregnancy, number of pregnancies), socio-demographic status (age, SES/education), developmental history (hormone composition), infants' birth characteristics (preterm birth), and factors related to the contextual sources of stress and support for parents (household size and job situation) cannot be manipulated or adapted by a preventive intervention. These unadaptable factors are most of the time 'given' characteristics where child healthcare professionals have to work with. However, researchers have to acknowledge that these unadaptable

factors affect the overall level of parental attachment and could be used to create different (sub) interventions addressing the severity of these factors or could be used to create specific interventions for subgroups with (expectant) parents that were identified with multiple unadaptable factors, for instance an attachment intervention established for parents with preterm born infants (Evans, Boyd, Colditz, Sanders, & Whittingham, 2017; Meijssen et al., 2011).

Three adaptable factors of parental attachment were breastfeeding, bedsharing and parenting stress. These three factors were mentioned in the preventive interventions, but only once or thrice, due to the following reasons:

First, it was found that breastfeeding continuation for more than six months after birth contributed to secure parental attachment (Britton, Britton, & Gronwaldt, 2006; Tharner et al., 2012). Normally, midwives inform and support expectant mothers about the breastfeeding practices, but in a meta-analytic study of Schmied, Beake, Sheehan, McCourt, and Dykes (2011), evidence was found that person-centred communication skills and relationships to support a mother to breastfeed are not only work for midwives. They argued that organizational systems and services such as preventive interventions could also facilitate the continuity of peer/professional support models which could address the importance of breastfeeding continuation. This means that child healthcare professionals could also support (expectant) mothers by addressing breastfeeding practices in preventive interventions to ensure secure parental attachment.

Second, the bedsharing habits of parents was a factor that impeded secure parental attachment. This effect was unexpected, since other research found conflicting evidence. In the systematic narrative analysis of Ward (2015), evidence was found that bedsharing habits also benefitted both mother and infant by being emotionally and physically comforting, which facilitates secure parental attachment. However, many professionals rely on the recommendations of the American Academy of Pediatrics (AAP) in which they recommend no bedsharing situation as safe, but that is mostly due to the possibility of a sudden unexpected infant death (SUDI) syndrome (Task Force on Sudden Infant Death Syndrome, 2016). This means that child healthcare professionals should inform (expectant) parents not to bedshare, since it negatively affects parental attachment and could lead to SUDI.

Third, (expectant) parents could develop parenting stress, indicating that parents experience difficulties in adjusting to the parenting role. Three intervention studies addressed this factor and these three intervention studies also addressed the factor of the mental health state. Thus, it was expected that parenting stress is related to the mental health state of parents. In the study of Leigh and Milgrom (2008), evidence was found that the relationship between parenting stress and mental health problems such as a postnatal depression appeared to be reciprocal, however a postnatal depression was still the strongest predictor for parenting stress. This means that when preventive interventions address the factor of the mental health state, this relates to reducing parenting stress.

In short, all the adaptable and unadaptable factors need to be addressed in improved and adjusted preventive interventions or newly developed preventive interventions. Besides, the 16 identified contributing and impeding factors of secure parental attachment need to be addressed by not only child healthcare professionals, but multiple healthcare professionals, such as the midwife, neonatal care nurse, gynaecologist, paediatrician, general practitioner and psychologist.

4.2 Strengths and limitations

In the present study there are several strengths and limitations that should be acknowledged and in a latter case should be improved upon in future studies.

4.2.1 Strengths

A strength of the present study was the use of a narrative analysis as a study design. This exploratory study provides an overview of detailed academic literature, which was obtained in a systematic manner with the use of the mini-review protocol of Griffiths (2002). For child healthcare professionals, this exploratory research assists them in making informed choices in the field of parental attachment behaviour. The data that was used in this study came from longitudinal, cross-sectional or correlational designs and RCTs, protocol-RCTs and longitudinal pre-post-tests designs. In all the included study designs, data from a community-based sample in Western countries after 2010 was used, which fits the universality of the attachment theories, since these are biased towards the Western countries. This makes the findings of the present study applicable to child healthcare professionals working in Western countries like USA, Canada, Australia, New-Zealand and countries in Western Europe.

The second strength was about the time phase used in the present study. The understanding of the 1001 critical days is a new concept within the academic literature. Since the manifest of the 1001 critical days started in 2013, the concept is gaining more attention. For example, the 1001 critical days is used in current policy documents of the Ministry of Health, Welfare and Sport in the Netherlands. Because of this new concept, the present study focussed on prenatal (prior to birth) and postnatal (after birth) factors. This could lead to new insights in academic literature, which is strengthening this study and could be compared with other previously conducted research focussing on only prenatal or only postnatal factors.

The last strength was related to the categorization of identified factors. In the present study, the ecological model of determinants of parenting was used for the categorization of identified factors. The determinants of parenting of Belsky (1984) are widely used in academic literature and captures three general sources of parental functioning; individual characteristics of the mother and father, characteristics of the infant and contextual sources of stress and support for the parents. The determinants of parenting ensure transparency within the present study, since these three general sources were used and explained based on their effectiveness. However, there was also a downside related to the ecological model of determinants, since the model did not serve interactions, which means that interactions between parents and infants were only addressed from one side. For instance the factor breastfeeding is an interaction-factor which was now seen from the perspective of the individual mother, but also relates to the characteristics of the infant. Another example is related to the behaviour of the mother or father. The ecological model did not emphasise the importance of specific behaviours, since it focuses mostly on the personality or psychological well-being of the individual parent, for instance bedsharing is an adaptable behaviour which was difficult to categorize, because it contains a behaviour. The last example relates to the contextual sources of stress and support. In the ecological model, the marital status fitted this determinant, but technically this determinant is also a socio-demographic status and these socio-demographic status-related factors fitted the determinant of the individual characteristic of the mother and father, which contains the age and SES/education. These three examples represent that the ecological model of determinants of parenting is a supporting model to categorize identified factors, but

could be optimized especially to explain factors related to parental attachment behaviour. An adjusted model could be designed, but it is behind the scope of the present study to propose an optimized model of determinants of parenting.

4.2.2 Limitations

A limitation of the present study was related to the different measurement instruments that were used in each included study for the identification of factors of parental attachment. For instance for measuring the level of prenatal attachment, the maternal antenatal attachment scale (MAAS) was used or the maternal fetal attachment scale (MFAS) was used, which contain both different reliability consistencies and different questions within each questionnaire. With regard to the measurement of symptoms of depression, most studies used the Edinburgh postnatal depression scale (EPDS) while other studies used the depression anxiety stress scale (DASS) or the postpartum depression screening scale (PDSS). The differences in measurement instruments could limit the reliability of the included studies about factors of parental attachment. The same can be said about the intervention studies, some interventions actually measure the level of attachment by conducting the Strange Situation Procedure (SSP), while other studies did not. Some intervention studies were only a protocol of a going to be performed RCT, which means that the effectiveness of the intervention is not proven yet. This means that the characteristics of the different included studies are diverse and this could limit the validity and reliability of the present study. A solution that could be proposed to tackle this limitation is to conduct a meta-analysis. In a meta-analytic study significances and effect sizes are calculated from the measurement instruments that were used in each individual study. Eventually, this also assists the researcher in calculating and explaining the most powerful predictor of the study.

The second limitation of the present study was related to the inclusion of intervention studies. The intervention studies were all international interventions that were developed in other countries than the Netherlands. Unfortunately, due to this limitation the researcher obtained little information about the Dutch youth health care situation. This was not expected, because Dutch youth health care is addressing attachment behaviour in their policy. In the Netherlands, there are interventions developed that comprised components of attachment behaviour, such as Voorzorg (Mejdoubi et al., 2015). However,

Voorzorg was not only focussing on attachment behaviour, but also addresses for instance child maltreatment. Even though, there are more interventions in the Netherlands with attachment behaviour as a component, these were not tested on their effectiveness. Therefore, further research is necessary in the Netherlands with the aim to analyse current Dutch preventive interventions and to add identified factors of parental attachment in order to ensure secure parental attachment in the first 1001 critical days after conception.

The last limitation of the present study was the not equally involvement of risk populations. Most of the risk populations consisted of mentally ill mothers, adolescents, parents who experienced domestic violence and abuse or other. However, a risk group which consisted of mothers with intellectual disabilities was not discovered in this mini-review, but it was acknowledged that mothers with an intellectual disability have problems with the developmental tasks of raising their child (Granqvist, Forslund, Fransson, Springer, & Lindberg, 2014). Another risk group was related to mothers who experience an eating disorder such as anorexia nervosa and bulimia nervosa. In a review of Ward, Ramsay, and Treasure (2000), they found that insecure attachment is common in eating disordered populations. Moreover, in the inclusion criteria of the present study was mentioned that same-sex lesbian couples were included in the analysis, however no studies were found that focussed on this group. In studies of Golombok, Tasker, and Murray (1997); MacCallum and Golombok (2004), evidence was found that infants raised in fatherless families were experiencing greater warmth and interaction with their mothers. This indicates that the absence of a father did not affect the level of attachment between mother and infant. Overall, this means that in the present study not all the risk populations were involved and this could have influenced the generalizability of the study.

4.3 Implications

The findings of the present study have clinical implications for child healthcare professionals and future research.

The first implication is related to the first 1001 critical days after conception. Since the development of this phenomenon in 2013, the first 1001 critical days after conception gained more attention (Detmar et al., 2016). Although, it should be noted that the period before conception, the pre-conception phase, is also of importance. Preconception care (PPC) is concerned

about the improvement of perinatal outcomes before the conception. The main goal of PCC is to provide health promotion, screening and interventions for reproductive women to reduce risk factors that might affect a future pregnancy (Johnson et al., 2006). Thereby, this pre-conception period should not be forgotten for the optimal outcomes of infant development with secure attachment between parents and an (unborn) infant. In the Netherlands, pre-conception care is not standard care, but it is recommended to offer pre-conception care to expectant parents (Schonewille-Rosman, Steegers-Theunissen, & Steegers, 2018). The Dutch Ministry of Health Welfare and Sport (2018) acknowledge the importance of pre-conception care and integrated pre-conception care in their action programme of a 'Promising Start'.

At last, the present study emphasised the importance of striving for optimal attachment behaviour between parents and an (unborn) infant. The identified contributing and impeding factors of secure parental attachment need to be acknowledged by child healthcare professionals. Therefore, preventive evidence-based interventions have to be improved, adjusted or newly developed to ensure secure parental attachment. Since the intervention will be performed by child healthcare professionals, it is recommended that the attachment-related intervention is going to be performed during the prenatal and postnatal phase with sessions for both mothers and fathers. Based on the determinants of parenting, the findings of the present study reveal that the factors of mental health, own childhood history, representations of an (unborn) infant, infant temperament and the marital relationship have to be integrated in the preventive evidence-based intervention. Besides, the other (un)adaptable factors of parental attachment have to be taken into account for assisting individual parents by attachment-related difficulties during the first 1001 critical days after conception. This means that additional research is preferred, in which specific parenting-groups are asked about their preferences about a preventive evidence-based parental attachment intervention to strive for optimal attachment behaviour between parents and an (unborn) infant. Regarding the Netherlands, the first essential step is to conduct follow-up research to guarantee the transition of the identified factors of parental attachment within current Dutch preventive interventions to ensure secure parental attachment in the first 1001 critical days after conception.

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References

- Ainsworth, M. (1978). *Patterns of attachment*. Hillsdale, N.J; New York: Lawrence Erlbaum Associates ; Distributed by Halsted Press Division of Wiley.
- Ainsworth, M., & Bell, S. (1970). Attachment, exploration, and separation: illustrated by the behavior of one-year-olds in a strange situation. *Child development*.
- Assink, M., Spruit, A., Schuts, M., Lindauer, R., van der Put, C. E., & Stams, G.-J. J. M. (2018). The intergenerational transmission of child maltreatment: A three-level meta-analysis. *Child abuse & neglect*, 84, 131-145.
- Bakermans-Kranenburg, M. J., Van IJzendoorn, M. H., & Juffer, F. (2003). Less is more: meta-analyses of sensitivity and attachment interventions in early childhood. *Psychological bulletin*, 129(2), 195.
- Balbernie, R. (2001). Circuits and circumstances: The neurobiological consequences of early relationship experiences and how they shape later behaviour. *Journal of child psychotherapy*, 27(3), 237-255.
- Belsky, J. (1984). The determinants of parenting: A process model. *Child development*, 83-96.
- Belsky, J., & de Haan, M. (2011). Annual research review: Parenting and children's brain development: The end of the beginning. *Journal of Child Psychology and Psychiatry*, 52(4), 409-428.
- Blizzard, A. M., Barroso, N. E., Ramos, F. G., Graziano, P. A., & Bagner, D. M. (2018). Behavioral parent training in infancy: what about the parent–infant relationship? *Journal of Clinical Child & Adolescent Psychology*, 47(sup1), S341-S353.
- Boris, N. W., & Zeanah, C. H. (2005). Practice parameter for the assessment and treatment of children and adolescents with reactive attachment disorder of infancy and early childhood. *Journal of the American Academy of Child & Adolescent Psychiatry*, 44(11), 1206-1219.
- Bowlby, J. (1958). The nature of the child's tie to his mother. *International journal of psycho-analysis*, 39, 350-373.
- Bowlby, J. (1969). *Attachment and loss*. New York: Basic Books.
- Bowlby, J. (1973). Attachment and loss: Volume II: Separation, anxiety and anger. In *Attachment and Loss: Volume II: Separation, Anxiety and Anger* (pp. 1-429): London: The Hogarth Press and the Institute of Psycho-Analysis.
- Brandon, A. R., Pitts, S., Denton, W. H., Stringer, C. A., & Evans, H. (2009). A history of the theory of prenatal attachment. *Journal of prenatal & perinatal psychology & health: APPPAH*, 23(4), 201.
- Britton, J. R., Britton, H. L., & Gronwaldt, V. (2006). Breastfeeding, sensitivity, and attachment. *Pediatrics*, 118(5), e1436-1443.
- Camarneiro, A. P. F., & de Miranda Justo, J. M. R. (2017). Prenatal attachment and sociodemographic and clinical factors in Portuguese couples. *Journal of Reproductive and Infant Psychology*, 35(3), 212-222.
- Condon, J. T. (1993). The assessment of antenatal emotional attachment: development of a questionnaire instrument. *British Journal of Medical Psychology*, 66(2), 167-183.
- Condon, J. T., Corkindale, C., Boyce, P., & Gamble, E. (2013). A longitudinal study of father-to-infant attachment: antecedents and correlates. *Journal of Reproductive and Infant Psychology*, 31(1), 15-30.
- Condon, J. T., & Corkindale, C. J. (1998). The assessment of parent-to-infant attachment: Development of a self-report questionnaire instrument. *Journal of Reproductive and Infant Psychology*, 16(1), 57-76.
- Cranley, M. S. (1981). Development of a tool for the measurement of maternal attachment during pregnancy. *Nursing Research*
- Dayton, C. J., Brown, S., Goletz, J., Hicks, L., Barron, C., Sperlich, M., & Smith-Darden, J. (2019). Pathways to Parenting: Predictors of Prenatal Bonding in a Sample of Expectant Mothers and Fathers Exposed to Contextual Risk. *Journal of Child and Family Studies*, 28(4), 1134-1144.
- Dayton, C. J., Levendosky, A. A., Davidson, W. S., & Bogat, G. A. (2010). The child as held in the mind of the mother: The influence of prenatal maternal representations on parenting behaviors. *Infant Mental Health Journal: Official Publication of The World Association for Infant Mental Health*, 31(2), 220-241.
- Dekel, S., Thiel, F., Dishy, G., & Ashenfarb, A. L. (2019). Is childbirth-induced PTSD associated with low maternal attachment? *Archives of women's mental health*, 22(1), 119-122.
- Detmar, S., van Buuren, S., Schuren, F., de Wolff, M., & Clabbers, N. H., K. (2016). *Investing in the first 1000 days of life for a healthy future*. TNO
- Dykas, M. J., & Cassidy, J. (2011). Attachment and the processing of social information across the life span: theory and evidence. *Psychological bulletin*, 137(1), 19.
- Erickson, M. F., & Egeland, B. (2004). Linking theory and research to practice: The Minnesota Longitudinal Study of Parents and Children and the STEEP™ program. *Clinical Psychologist*, 8(1), 5-9.

- Evans, T., Boyd, R. N., Colditz, P., Sanders, M., & Whittingham, K. (2017). Mother-very preterm infant relationship quality: RCT of Baby Triple P. *Journal of Child and Family Studies*, 26(1), 284-295.
- Evans, T., Whittingham, K., & Boyd, R. (2012). What helps the mother of a preterm infant become securely attached, responsive and well-adjusted? *Infant Behavior and Development*, 35(1), 1-11.
- Gavin, N. I., Gaynes, B. N., Lohr, K. N., Meltzer-Brody, S., Gartlehner, G., & Swinson, T. (2005). Perinatal depression: a systematic review of prevalence and incidence. *Obstetrics & Gynecology*, 106(5), 1071-1083.
- George, C., Kaplan, N., & Main, M. (1985). The Berkeley adult attachment interview. *Unpublished protocol, Department of Psychology, University of California, Berkeley*.
- Goecke, T., Voigt, F., Faschingbauer, F., Spangler, G., Beckmann, M., & Beetz, A. (2012). The association of prenatal attachment and perinatal factors with pre- and postpartum depression in first-time mothers. *Archives of gynecology and obstetrics*, 286(2), 309-316.
- Golombok, S., Tasker, F., & Murray, C. (1997). Children raised in fatherless families from infancy: Family relationships and the socioemotional development of children of lesbian and single heterosexual mothers. *Journal of Child Psychology and Psychiatry*, 38(7), 783-791.
- Granqvist, P., Forslund, T., Fransson, M., Springer, L., & Lindberg, L. (2014). Mothers with intellectual disability, their experiences of maltreatment, and their children's attachment representations: A small-group matched comparison study. *Attachment & human development*, 16(5), 417-436.
- Griffiths, P. (2002). Evidence informing practice: introducing the mini-review. *British Journal of Community Nursing*, 7(1), 38-40.
- Hall, R. A., Hoffenkamp, H. N., Tooten, A., Braeken, J., Vingerhoets, A. J., & Van Bakel, H. J. (2015). Child-rearing history and emotional bonding in parents of preterm and full-term infants. *Journal of Child and Family Studies*, 24(6), 1715-1726.
- Hoffman, K. T., Marvin, R. S., Cooper, G., & Powell, B. (2006). Changing toddlers' and preschoolers' attachment classifications: the Circle of Security intervention. *Journal of Consulting Clinical Psychology*, 74(6), 1017.
- Johnson, K., Posner, S. F., Biermann, J., Cordero, J. F., Atrash, H. K., Parker, C. S., . . . Curtis, M. G. (2006). Recommendations to Improve Preconception Health and Health Care—United States: Report of the CDC/ATSDR Preconception Care Work Group and the Select Panel on Preconception Care. *Morbidity and Mortality Weekly Report: Recommendations and Reports*, 55(6), 1-CE-4.
- Kerstis, B., Aarts, C., Tillman, C., Persson, H., Engström, G., Edlund, B., . . . Skalkidou, A. (2016). Association between parental depressive symptoms and impaired bonding with the infant. *Archives of women's mental health*, 19(1), 87-94.
- Klaus, M. H., & Kennell, J. H. (1976). *Maternal-infant bonding : the impact of early separation or loss on family development*. Saint Louis; London: Mosby ; Distributed by Kimpton.
- Leigh, B., & Milgrom, J. (2008). Risk factors for antenatal depression, postnatal depression and parenting stress. *BMC psychiatry*, 8(1), 24.
- Leung, L. (2015). Validity, reliability, and generalizability in qualitative research. *Journal of family medicine and primary care*, 4(3), 324-327.
- Ludmer, J. A., Gonzalez, A., Kennedy, J., Masellis, M., Mainz, P., & Atkinson, L. (2018). Association between maternal childhood maltreatment and mother-infant attachment disorganization: Moderation by maternal oxytocin receptor gene and cortisol secretion. *Hormones and behavior*, 102, 23-33.
- MacCallum, F., & Golombok, S. (2004). Children raised in fatherless families from infancy: a follow-up of children of lesbian and single heterosexual mothers at early adolescence. *Journal of Child Psychology and Psychiatry*, 45(8), 1407-1419.
- Macdonald, G., Alderdice, F., Clarke, M., Perra, O., Lynn, F., McShane, T., & Millen, S. (2018). Right from the start: protocol for a pilot study for a randomised trial of the New Baby Programme for improving outcomes for children born to socially vulnerable mothers. *Pilot and feasibility studies*, 4(1), 44.
- Main, M., Kaplan, N., & Cassidy, J. (1985). Security in infancy, childhood, and adulthood: A move to the level of representation. *Monographs of the society for research in child development*.
- Meijssen, D., Wolf, M.-J., van Bakel, H., Koldewijn, K., Kok, J., & van Baar, A. (2011). Maternal attachment representations after very preterm birth and the effect of early intervention. *Infant Behavior and Development*, 34(1), 72-80.
- Mejdoubi, J., van den Heijkant, S. C., van Leerdam, F. J., Heymans, M. W., Crijnen, A., & Hirasing, R. A. (2015). The effect of VoorZorg, the Dutch nurse-family partnership, on child maltreatment and development: a randomized controlled trial. *PLoS One*, 10(4), e0120182.

- Mihelic, M., Morawska, A., & Filus, A. (2018). Preparing parents for parenthood: protocol for a randomized controlled trial of a preventative parenting intervention for expectant parents. *BMC pregnancy and childbirth*, 18(1), 311.
- Mikulincer, M., Shaver, P. R., & Pereg, D. (2003). Attachment theory and affect regulation: The dynamics, development, and cognitive consequences of attachment-related strategies. *Motivation and emotion*, 27(2), 77-102.
- Ministry of Health Welfare and Sport. (2018). *Actieprogramma Kansrijke start*.
- Mitchell, E. A., Hutchison, B. L., Thompson, J. M., & Woudes, T. A. (2015). Exploratory study of bed-sharing and maternal-infant bonding. *Journal of paediatrics and child health*, 51(8), 820-825.
- Moe, V., Von Soest, T., Fredriksen, E., Olafsen, K. S., & Smith, L. (2018). The Multiple Determinants of Maternal Parenting Stress 12 Months After Birth: The Contribution of Antenatal Attachment Style, Adverse Childhood Experiences, and Infant Temperament. *Frontiers in psychology*, 9, 1987.
- Muller. (1993). Development of the prenatal attachment inventory. *Western Journal of Nursing Research*, 15(2), 199-215.
- Muller. (1996). Prenatal and postnatal attachment: A modest correlation. *Journal of Obstetric, Gynecologic, & Neonatal Nursing*, 25(2), 161-166.
- Muller, R., Sicoli, A., & Lemieux, E. (2000). Relationship between attachment style and posttraumatic stress symptomatology among adults who report the experience of childhood abuse. *Journal of Traumatic Stress: Official Publication of The International Society for Traumatic Stress Studies*, 13(2), 321-332.
- Muzik, M., Bocknek, E. L., Broderick, A., Richardson, P., Rosenblum, K. L., Thelen, K., & Seng, J. S. (2013). Mother–infant bonding impairment across the first 6 months postpartum: the primacy of psychopathology in women with childhood abuse and neglect histories. *Archives of women's mental health*, 16(1), 29-38.
- Nolvi, S., Karlsson, L., Bridgett, D. J., Pajulo, M., Tolvanen, M., & Karlsson, H. (2016). Maternal postnatal psychiatric symptoms and infant temperament affect early mother-infant bonding. *Infant Behavior and Development*, 43, 13-23.
- O'Neill, A., Swigger, K., & Kuhlmeier, V. (2018). 'Make the Connection' parenting skills programme: a controlled trial of associated improvement in maternal attitudes. *Journal of Reproductive and Infant Psychology*, 36(5), 536-547.
- Ramsauer, B., Lotzin, A., Mühlhan, C., Romer, G., Nolte, T., Fonagy, P., & Powell, B. (2014). A randomized controlled trial comparing Circle of Security Intervention and treatment as usual as interventions to increase attachment security in infants of mentally ill mothers: Study Protocol. *BMC psychiatry*, 14(1), 24.
- Rees, C. (2007). Childhood attachment. *The British journal of general practice : the journal of the Royal College of General Practitioners*, 57(544), 920-922.
doi:10.3399/096016407782317955
- Roisman, G. I., Tsai, J. L., & Chiang, K.-H. S. (2004). The emotional integration of childhood experience: physiological, facial expressive, and self-reported emotional response during the adult attachment interview. *Developmental psychology*, 40(5), 776.
- Rosenblum, K. L., Dayton, C. J., & Muzik, M. (2009). Infant social and emotional development. *Handbook of infant mental health*, 3, 80-103.
- Rossen, L., Hutchinson, D., Wilson, J., Burns, L., Olsson, C. A., Allsop, S., . . . Mattick, R. P. (2016). Predictors of postnatal mother-infant bonding: the role of antenatal bonding, maternal substance use and mental health. *Archives of women's mental health*, 19(4), 609-622.
- Rothbaum, F., Weisz, J., Pott, M., Miyake, K., & Morelli, G. (2000). Attachment and culture: Security in the United States and Japan. *American Psychologist*, 55(10), 1093.
- Rowe, H. J., Wynter, K. H., Steele, A., Fisher, J. R., & Quinlivan, J. A. (2013). The growth of maternal-fetal emotional attachment in pregnant adolescents: a prospective cohort study. *Journal of pediatric and adolescent gynecology*, 26(6), 327-333.
- Rubin, R. (1967). Attainment of the maternal role: Part I. Processes. *Nurs Res*, 16(3), 237-245.
- Sanders, M. R. (1999). Triple P-Positive Parenting Program: Towards an empirically validated multilevel parenting and family support strategy for the prevention of behavior and emotional problems in children. *Clinical child and family psychology review*, 2(2), 71-90.
- Schmidt, D., Seehagen, S., Vocks, S., Schneider, S., & Teismann, T. (2016). Predictive importance of antenatal depressive rumination and worrying for maternal–foetal attachment and maternal well-being. *Cognitive Therapy and Research*, 40(4), 565-576.
- Schmied, V., Beake, S., Sheehan, A., McCourt, C., & Dykes, F. (2011). Women's perceptions and experiences of breastfeeding support: a metasynthesis. *Birth*, 38(1), 49-60.

- Schonewille-Rosman, A. N., Steegers-Theunissen, R. P. M., & Steegers, E. A. P. (2018). Preconception care in 2018; still too many missed opportunities. *Nederlands tijdschrift voor geneeskunde*, 162.
- Sheridan, M., & Nelson, C. A. (2009). Neurobiology of fetal and infant development. *Handbook of infant mental health*, 3, 40-58.
- Sroufe, L. A. (1988). The role of infant-caregiver attachment in development. *Clinical implications of attachment*, 18-38.
- Stern, D. N. (1995). *The motherhood constellation: A unified view of parent–infant psychotherapy*. New York, NY, US: Basic Books.
- Suess, G., Bohlen, U., Carlson, E., Spangler, G., & Frumentia Maier, M. (2016). Effectiveness of attachment based STEEP™ intervention in a German high-risk sample. *Attachment & human development*, 18(5), 443-460.
- Svanberg, P., Mennet, L., & Spieker, S. (2010). Promoting a secure attachment: A primary prevention practice model. *Clinical Child Psychology and Psychiatry*, 15(3), 363-378.
- Tani, F., Castagna, V., & Ponti, L. (2018). Women who had positive relationships with their own mothers reported good attachments to their first child before and after birth. *Acta Paediatrica*, 107(4), 633-637.
- Task Force on Sudden Infant Death Syndrome. (2016). SIDS and other sleep-related infant deaths: Updated 2016 recommendations for a safe infant sleeping environment. *Pediatrics*, 138(5), e20162938.
- Tharner, A., Luijk, M. P., Raat, H., IJzendoorn, M. H., Bakermans-Kranenburg, M. J., Moll, H. A., . . . Tiemeier, H. (2012). Breastfeeding and its relation to maternal sensitivity and infant attachment. *Journal of Developmental & Behavioral Pediatrics*, 33(5), 396-404.
- Thomas, N., Komiti, A., & Judd, F. (2014). Pilot early intervention antenatal group program for pregnant women with anxiety and depression. *Archives of women's mental health*, 17(6), 503-509.
- Torres, B., Alonso-Arbiol, I., Cantero, M. J., & Abubakar, A. (2011). Infant-mother attachment can be improved through group intervention: a preliminary evaluation in Spain in a non-randomized controlled trial. *The Spanish journal of psychology*, 14(2), 630-638.
- Væver, M. S., Smith-Nielsen, J., & Lange, T. (2016). Copenhagen infant mental health project: study protocol for a randomized controlled trial comparing circle of security–parenting and care as usual as interventions targeting infant mental health risks. *BMC psychology*, 4(1), 57.
- van der Zee-van den Berg, A. I., Boere-Boonekamp, M. M., Groothuis-Oudshoorn, C. G. M., IJzerman, M. J., Haasnoot-Smallegange, R. M. E., & Reijneveld, S. A. (2017). Post-Up Study: Postpartum Depression Screening in Well-Child Care and Maternal Outcomes. *Pediatrics*, 140(4), e20170110.
- Van IJzendoorn, M. H. (1995). Adult attachment representations, parental responsiveness, and infant attachment: a meta-analysis on the predictive validity of the Adult Attachment Interview. *Psychological bulletin*, 117(3), 387.
- Van IJzendoorn, M. H., & Bakermans-Kranenburg, M. J. (2010). Invariance of adult attachment across gender, age, culture, and socioeconomic status? *Journal of social and personal relationships*, 27(2), 200-208.
- Vreeswijk, C. M., Maas, A. J., Rijk, C. H., & van Bakel, H. J. (2014). Fathers' experiences during pregnancy: Paternal prenatal attachment and representations of the fetus. *Psychology of Men & Masculinity*, 15(2), 129.
- Ward, A., Ramsay, R., & Treasure, J. (2000). Attachment research in eating disorders. *British Journal of Medical Psychology*, 73(1), 35-51.
- Ward, T. C. S. (2015). Reasons for Mother–Infant Bed-Sharing: A Systematic Narrative Synthesis of the Literature and Implications for Future Research. *Maternal and child health journal*, 19(3), 675-690. doi:10.1007/s10995-014-1557-1
- Weaver, R. H., & Cranley, M. S. (1983). An exploration of paternal-fetal attachment behavior. *Nursing Research*.
- Wynter, K., Rowe, H., Tran, T., & Fisher, J. (2016). Factors associated with father-to-infant attachment at 6 months postpartum: a community-based study in Victoria, Australia. *Journal of Reproductive and Infant Psychology*, 34(2), 185-195.
- Yarcheski, A., Mahon, N. E., Yarcheski, T. J., Hanks, M. M., & Cannella, B. L. (2009). A meta-analytic study of predictors of maternal-fetal attachment. *International journal of nursing studies*, 46(5), 708-715.
- Zeanah, C. H., & Gleason, M. M. (2010). Reactive attachment disorder: A review for DSM-V. *Report presented to the American Psychiatric Association*.

Appendix A. Features of included studies for full text analysis

Author	Objective	Study design	Study sample (n)	Ethics and informed consent	Country	Measurement instruments	Time phase	Main findings of the study	Validity	Reliability	Generalizability	Inclusion
Camarero et al. (2017)	Aim to observe differences between maternal and paternal prenatal attachment as a function of sociodemographic and clinical/obstetric factors	Correlational study	n=814 mothers and fathers, resulting in n=407 couples	Yes and Yes	Central Portugal	Socio-demographic and clinical questionnaire, Portuguese version of Maternal Antenatal Attachment Scale (MAAS) and Paternal Antenatal Attachment Scale (PAAS)	Prenatal T2	Significant differences in maternal prenatal attachment for age, education, SES, pregnancy planning, previous pregnancies, pregnancy interruptions and gestational age. For paternal prenatal attachment in age, number of children, SES, occupational status, family household, pregnancy planning	Valid measures, but data analysis was difficult using MANOVA	No consistencies were given, significances were given	Study focused on both mothers and fathers, Portugal is Western Europe	
Condon et al. (2013)	Aim to investigate the relationship between a father's antenatal attachment to the fetus and his subsequent attachment to his infant at 6 and 12 months postnatally	Longitudinal and cross-sectional study	n=904 fathers were recruited and n=204 first time fathers completed study	Not mentioned	Australia	Paternal Antenatal Attachment Scale (PAAS), Paternal postnatal attachment scale (PPAS), Mental Health Index (MHI-5), Positive and Negative Affect Schedule (PANAS), Edinburgh Postnatal Depression Scale (EPDS), Self-Assessment of Irritability Scale (SAIS), Dyadic Adjustment Scale (DAS), Social Support Questionnaire (SSQ), Intimate Bond measure (IBM), Infant Characteristics Questionnaire (ICQ), Parental bonding instrument (PBI)	Prenatal T2, Postnatal M3, Postnatal M6 and Postnatal M12	Strong continuity of attachment across these three assessment points as well as the important influence of the man's partner relationship and mental well-being on his attachment	All measures were validated. Because of cross-sectional research element confounding effects cannot be measured	All measurement instruments were valid and of high reliability.	One would think that different outcomes would occur for a high-risk group of fathers	
Dayton et al. (2019)	Aim to examine the influence of the accumulation of psychiatric conditions (psychological distress) on prenatal bonding in a sample of mothers and fathers who reported high levels of exposure to contextual adversity	Longitudinal study	n=51 expectant mothers and n=51 biological fathers, total = n=102. Risk group: Exposure to environmental stressors such as poverty and violence	Yes and Yes	Detroit, Michigan USA	Maternal/Paternal Antenatal Attachment Scale (MAAS/PAAS), Edinburgh Postpartum Depression Scale (EPDS), State-Trait Anxiety Inventory (STAI), Post-traumatic Symptom Disorder Checklist-Civilian (PCL-C), Childhood Trauma Questionnaire (CTQ), Multidimensional Perceived Social Support Scale (MPSS); Role of the father questionnaire (ROFQ)	Prenatal T3	Mothers: psychological distress (PTSD) is associated with maternal-fetal bonding. Fathers: history of child-maltreatment and views of fathering are associated with bonding	Small study sample, so bias could occur. Insignificance of social support was not expected. Use of valid measurements	Consistency was given. Significant findings of relevance.	Small study sample. Risk group with poverty and violence, so less generalizable.	
Dekel et al. (2019)	Aim to investigate whether PP-PTSD symptoms limit maternal attachment even more than non-childbirth PTSD and whether PP-PTSD interferes with maternal attachment above and beyond premorbid factors	Cross-sectional study	N=685 mothers	Yes and Yes	Massachusetts, USA	Maternal Assessment Inventory (MAI), Peritraumatic Distress Inventory (PDI)	Postnatal M6	Childbirth-induced posttraumatic stress (PTSD) may interfere with the formation of maternal attachment. PP-PTSD predicted less maternal attachment above and beyond pre-birth psychiatric conditions, acute distress in birth and lack of breastfeeding	It was an online sample so bias can occur. Nothing said about confounding.	Consistency was given. Nothing said about significances, only using ANOVA and variances	No clinical diagnosis was not used for assessment of PTSD symptoms.	
Dubber et al. (2015)	Aim to identify the influence of maternal pre- and postnatal symptoms of depression and anxiety and maternal-fetal bonding during pregnancy on postpartum bonding	Longitudinal study	n=433 mothers were recruited, n=334 were included in the little's MCAR test, resulting in n=80 mothers having no missing values. N=30 mothers completed study	Yes and Yes	Heidelberg, Germany	Edinburgh Postnatal depression scale (EPDS), State-Trait Anxiety Inventory (STAI), Pregnancy related anxiety questionnaire (PRAQ), Maternal-Fetal Attachment Scale (MFAS), Postpartum bonding questionnaire (PBQ)	Prenatal T3 and Postnatal M3	Negative relationship between maternal-fetal bonding and postpartum maternal bonding impairments as well as the role of postpartum depressive symptoms	Little MCAR was performed resulting in small sample. Confounding effects were mentioned	The consistency was mentioned medium-sized effect of 20,8%. Self-reported questionnaires	Restrictive study sample of n=30 limits the generalizability	

Evans et al. (2012)	Aim to investigate the relationship between the predictor variables of experiential avoidance, relationship satisfaction, prenatal expectations (compared to postnatal experience) and postpartum support and the criterion variables of maternal attachment, psychological symptoms and maternal responsiveness after controlling for birth weight	Correlational study	n=127 mothers who gave birth to preterm born infants	Yes and No	Queensland, Australia	Demographic questionnaire, Postpartum support questionnaire, Prenatal expectations compared to postnatal experience questionnaire, Maternal Postnatal Attachment Scale, Maternal Infant Responsiveness Instrument (MIRI), Acceptance and Action Questionnaire (AAQ), Depression Anxiety Scale (DASS), Relationship Quality Index Questionnaire (RQI),	Postnatal M17	A preterm birth negatively impacts maternal attachment, maternal psychological symptoms and maternal responsiveness. For maternal attachment only no experiential avoidance and prenatal experiences are significant contributors	Measures were valid, but only maternal self-reporting. Response bias could be the case. No confounding factors were mentioned	Consistency was given. This was a correlational research, thus cannot say anything about causality	Possible self-selection bias due to recruitment type. Mothers were of high socioeconomic status.
Goeck et al. (2012)	Aim to investigate associations between prenatal attachment of adult first-time mothers to the unborn child, perinatal factors and levels of depression before and up to 18 months after delivery	Longitudinal Study	n=161 first time mothers without risk factors, n=132 completed the study	No and Yes	Germany	Edinburgh Postnatal Depression Scale (EPDS), Maternal Antenatal Attachment Scale (MAAS), Questionnaire about pregnancy, data from the patient file	Prenatal T1, Postnatal M1, Postnatal M6 and Postnatal M18	Depressive symptoms during the last trimester and postpartum show stability over time even up to 18 months postpartum. The quality of prenatal attachment was negatively correlated with depressive symptoms during pregnancy and 3 weeks and 6 months postpartum. Mode of delivery and perinatal injuries have a significant influence on development of postpartum depressive symptoms and could be considered as risk factors	All the measures were valid and acceptable. The variables were tested for confounding for demographic and perinatal factors	Consistency was given. The test of correlations was good. Questionnaire was conducted by phone so socially desired answers could have been given	The sample consists of mostly high educated women, but they also developed depressive symptoms
Hall et al. (2015)	Aim to investigate links between prematurity, perceived child-rearing history and emotional bonding with a new-born infant in both mothers and fathers	Longitudinal study	n=406 (include both mothers and fathers); separated in three parts related to the preterm born infant	Yes and Yes	South of the Netherlands	Parental Bonding Instrument (PBI) and the Postpartum Bonding Questionnaire (PBQ)	Postnatal M1 and Postnatal M6	Mothers of preterm infants report higher feelings of bonding than mothers of full-term infants (no differences for fathers). Bonding with infant was strongly influenced by parents' perceptions of their own child-rearing history in both mothers and fathers of full-term and preterm infants	Good, well justified why PBI and PBQ was chosen in this sample	Good, internal consistency of measures was mentioned. Self-reported questionnaires were a limitation.	Sufficient, sample was not generalizable, all parents had bonding scores below the clinical threshold
Hopkins et al. (2018)	Aim 1: to examine the relation between social support, trait anxiety, symptoms of maternal distress (including stress, depression and anxiety) and maternal-fetal attachment. Aim 2: to determine if social support buffers the relation between trait anxiety, symptoms of distress and maternal-fetal attachment	Cross-sectional study	n=108 mothers were eligible, but n=94 mothers completed study	No and Yes	Midwest region of USA	Depression Anxiety Stress Scale (DASS-21), State Trait Anxiety Inventory Y-2 (STAI-T), Postpartum Social support questionnaire (PSSQ), Maternal Antenatal Attachment Scale (MAAS).	Prenatal T2	Prenatal attachment is related to trait anxiety and social support	Regression analyses were performed, nothing about potential bias or confounding, cross-sectional design was not favoured.	Consistency was given, including significances. They used self-reported questionnaires	Wide range of gestational ages (15-28 weeks), normally gestational age influences the attachment. Small study sample
Kersti et al. (2016)	Aim (1) to evaluate associations between maternal and paternal depressive symptoms and impaired bonding with their infant. (2) to determine the associations between parents' marital problems and impaired bonding with their infant	Longitudinal study	n=727 couples (both mothers and fathers), total n=1454	Yes and No	Uppsala in Sweden	Edinburgh Postnatal Depression Scale (EPDS), Postpartum Bonding Questionnaire (PBQ)	Postnatal M1 and Postnatal M6	Prevalence of impaired bonding was highest among couples in which both spouses had depressive symptoms. Impaired bonding was associated with higher EPDS scores in both mothers and fathers, as well as with experiencing a deteriorated marital relationship. Depressive symptoms at 6 weeks postpartum are associated with impaired bonding with the infant at 6 months postpartum for both mothers and fathers	Scales were validated. Scores of EPDS were tested with confounding factors.	Significances were mentioned, however only using OR's.	Lower prevalence of depressive symptoms among mothers and fathers compared to other studies. The n is good

Ludmer et al. (2018)	Aim to examine maternal oxytocin receptor(OXTR, rs53576) genotype and cortisol secretion as moderators of the relation between maternal childhood maltreatment history and disorganized mother-infant attachment in the SSP.	Cross-sectional study	n=314 low-risk mother infant dyads	Yes and No	Toronto Canada	Childhood maltreatment with CTQ Short Form, Strange Situation Test, Maternal cortisol samples, Maternal genotypes out of DNA of buccal cells, Maternal sensitivity with the Maternal Behavioural Q-Sort (MBQS), Beck Depression Inventory-2(BDI-2) and Parenting Stress Index-Short Form (PSI-SF)	Postnatal M17	Maternal OXTR genotypes and cortisol secretion moderate the relation between maternal history of childhood maltreatment and mother-infant attachment disorganization in the context of the Strange Situation Procedure	Lot of data preparation. Retrospective assessment of adverse childhood experiences was related to bias. Only controlled for ethnicity	Consistency was given, significances were given but difficult to interpret.	The SSP is mostly conducted among working older mothers, so not preferable to generalize for younger mothers	
Luz et al. (2017)	Aim to assess how adult romantic attachment dimensions (avoidance and anxiety), marital quality and psychological distress may influence the quality of parenting represented herein by parental (parent-to-infant) attachment and parenting alliance	Longitudinal study	n=400 participants were invited, but n=80 participants (40 couples) completed study	Yes and Yes	France	Experiences in close relationships (ECR), Hospital Anxiety and Depression scale (HADS), Dyadic adjustment scale (DAS), Maternal/ Paternal Antenatal Attachment Scale (MAAS/PAAS): Maternal/Paternal Postnatal Attachment Scale (MPAS/PPAS), Parenting alliance inventory (PAI)	Prenatal T3 and Postnatal M2	Mother: influenced by internal factors as adult attachment dimensions. Father: depend on mothers antenatal attachment to the child and on marital quality	The PLS method was used to search for significances, was related to SEM, but did not provide goodness of fit	Consistency was given, significances were mentioned	Participation was voluntary (selection bias)	
Magee et al. (2014)	Aim to examine the relationship between maternal-fetal attachment and patterns of maternal smoking among pregnant smokers	Longitudinal study	n=58 pregnant smokers, primarily low-income from diverse ethnic backgrounds	Yes and Yes	USA	Maternal fetal attachment scale (MFAS), Maternal cigarette smoking with samples of salivary cotinine and Timeline follow back (TLFB) Interview	Prenatal T3 and Postnatal M1	Among pregnant women who smoke, those with more feelings of affiliation and attachment to their fetus smoke fewer cigarettes per smoking occasion and have lower salivary cotinine concentrations than women with lower feelings of fetal attachment.	Other characteristics were not proposed in the model. No multiple regression analysis. The TGB Interview was very subjective.	Consistency of the measurement instrument was mentioned. Mothers could give social-acceptable answers.	Small sample size n=58, no biochemical verification of maternal smoking prior to study.	
Mazzechi et al. (2015)	Aim (1) to investigate the role of certain psychological aspects of maternal functioning during the transition to motherhood in a sample of first-time mothers; (2) to assess their unique role in maternal postnatal adjustment at the very beginning of the relationship with the new born infant	Longitudinal study	n=130 mothers were recruited, n=70 mothers completed whole study	Yes and Yes	Central Italy	Socio-demographic questionnaire, Attachment style questionnaire (ASQ), Discomfort with Closeness and Relationship anxiety, Maternal Antenatal Attachment scale (MAAS), Dyadic adjustment scale (DAS), Parenting stress index (PSI)	Prenatal T3 and Postnatal M4	Maternal attachment style was negatively correlated with prenatal attachment and with dyadic adjustment. Positive correlations resulted between prenatal attachment and dyadic adjustment	Design was called an observational prospective study, however looks more like longitudinal questionnaire study. Proposed model is small, only combining two variables	Consistency was mentioned for every measurement scale, effect sizes were mentioned. Most of the postnatal measurements were significant, self-reported questionnaires	Small sample of n=70, social context concerned first time mothers	
Mitchell et al. (2015)	Aim to investigate the relationship between bed-sharing and mother-infant bonding	Cross-sectional study	n=400 mothers selected, n=172 completed study	Yes and Yes	Auckland, New-Zealand	Postpartum Bonding Questionnaire (PBQ), Questions related to infant care practices	Postnatal M6	There is an inverse association between bed-sharing and maternal-infant bonding	PBQ was validated. Nothing said about confounding factors or bias.	PBQ was reliable, and validated in the study	Disparity between ethnicity	
Moe et al. (2018)	Aim: to investigate the prospective association between maternal attachment styles during pregnancy and parenting stress when infants are 12 months old.	Longitudinal study	n=1041 mothers wanted to participate, but n=1036 mothers started and n=744 mothers completed study	Yes and Yes	Norway	Experiences in close relationships (ECR) scale, Adverse childhood experiences (ACE-scale), Maternal cumulative risk during pregnancy by self-comprising risk indicators. Parenting Stress Index (PSI), Cameron-Rice Infant Temperament Questionnaire (CRITQ)	Prenatal T3 and Postnatal M12	Maternal attachment style assessed during pregnancy predicted parenting stress at twelve months after birth.	Design was with the use of SEM. It was not mentioned why SEM was used. Cognitive bias could occur	Consistency was given. Significances were given, do not understand why SEM method was chosen	Sample is big, sample was well educated. Mothers that quit during T3 had more cumulative risk	

Muzik et al. (2013)	Aim to explore the role of maternal psychopathology (depression and posttraumatic stress) and socioeconomic risk among women with childhood abuse and neglect histories and its impact on their attitudes towards parenting and their relationships with their infants	Longitudinal Study	n=150 mother-infant dyads. N=97 CA+ (childhood abuse) and N=53 CA- (no childhood abuse)	Not mentioned	USA	Demographic information, Postpartum Bonding Questionnaire (PBQ), Childhood Trauma Questionnaire (CTQ), National Women's Study PTSD Module, Postpartum Depression Screening Scale (PPDS), MACY Infant-Parenting Coding System for the home play segment during the home visit	Postnatal M1, Postnatal M4, Postnatal M12 and Postnatal M17	All women increased in bonding with their infant over the first 6 months postpartum, women with postpartum psychopathology (depression and posttraumatic stress disorder [PTSD]) showed consistently greater bonding impairment scores at all timepoints.	Validity of measurements was given, nothing said about bias or confounding, Observation bias could occur	Consistencies were mentioned, significant differences between CA+ and CA- group	Overrepresentation of the adult survivors of childhood abuse and neglect. Cannot be generalized for PTSD resultant from domestic violence or birth trauma.
Nolvi et al. (2016)	Aim to examine the effects of maternal postnatal depressive and anxiety symptoms and infant temperament traits on mother-infant bonding using both mother and father reports of infant temperament	Longitudinal Study	n=102 mothers and n=62 fathers completed whole study total = n=164	Yes and No	Finland	EPDS, State and Trait anxiety inventory (STAI), Postpartum bonding questionnaire PBQ, Infant behaviour questionnaire (IBQ)	Prenatal T2, Prenatal M3, Prenatal M6	After controlling for maternal symptoms of depression and anxiety, mother-reported infant positive emotionality, measured by infant smiling was related to better mother-infant bonding	Valid measurements, Correlations were okay. Nothing said about confounding and bias.	Consistency was given, significances were used in multiple regression analyses	Sample of fathers was not big. Not generalizable due to that they do not match clinical samples
O'Higgins et al. (2013)	Aim to examine the persistence of poor bonding over the first year and association between symptoms of postnatal depression and mother-infant bonding	Longitudinal study	n=3396 mothers were recruited, n=2048 filled in the EPDS questionnaire, n=50 completed study in the study group and n=29 in control group	Yes and Yes	London UK	Edinburgh Postnatal depression scale (EPDS) and the Mother Infant Bonding Scale (MIBS)	Postnatal M1, Postnatal M3, Postnatal M4 and Postnatal M12	A significant association between the EPDS score at four weeks and bonding score at 1-4 weeks, 9 weeks and at 1 year postnatal was found with a trend at 16 weeks. Strong association between bonding in early weeks and later time points. Early bonding rather than early depression was the major predictor of bonding at 1 year. Women who are depressed postnatally can fail to bond with their baby and this can persist for a year	Nothing said about bias or confounding. EPDS was validated for depression.	Consistency was given, including significances. They used self-reported questionnaires	Small sample size of n=50 depressed mothers.
Parfitt et al. (2014)	Aim to prospectively examine the impact of parental mental health (PTSD, depression, anxiety), the couple's relationship quality and the infant temperament on the parent-baby bond in first-time mothers and fathers	Longitudinal study	n=111 in total, n=61 mothers and n=50 fathers, these were all couples in T1. In T2 n=88 and in T3 n=71	No and Yes	Sussex, UK	Hospital Anxiety and Depression Scale (HADS), Dyadic Adjustment Scale (DAS), Posttraumatic Stress Diagnostic Scale (PDS), Infant characteristics (ICQ), parent-baby bond (PBQ)	Prenatal T3, Postnatal M3 and Postnatal M15	The parent-baby bond was associated with parental mental health, the couple's relationship and infant characteristics. T2: three months postpartum for both men and women were the couple's relationship during pregnancy and their baby's temperament. T3: at 15 months postpartum, after accounting for the parent-baby bond at 3 months, only concurrent infant temperament remained a significant predictor for women, men is relationship with their partner in pregnancy and concurrent affective symptoms.	Nothing said about bias or confounding. Sized could only be measured in the main variables and not within the subscale	Consistency was mentioned for every scale. Effect scales were moderate-large resulting in significant conclusions. Self-reported questionnaires	n=71 for T3 is quite small and the study sample consisted of white European and highly educated parents
Pisoni et al. (2016)	Aim to clarify the link between parents' prenatal attachment and psychological perinatal factors such as maternal depression, anxiety and social support	Cross-sectional study	n=43 couples with high-risk pregnancy, n=37 couples with no high-risk pregnancy (physiologic)	Yes and Yes	San Matteo, Italy	Sociodemographic questionnaire, Epidemiologic Studies Depression Scale (CES-D), State and Trait Anxiety Inventory (STAI), Multidimensional Scale of Perceived Social Support (MSPSS), Maternal/Paternal Antenatal Attachment Scale (MAAS/PAAS),	Prenatal, T3	Hospitalized expectant parents at risk of preterm delivery develop less attachment to the fetus and higher levels of anxiety and depression compared to the physiologic pregnancy group. Maternal antenatal attachment is an independent variable related to the diagnosis of a possible preterm delivery	Tests were valid, nothing said about possible bias or confounding.	Consistencies were not mentioned. Correlations were measured resulting in significances.	Small sample size, heterogeneity of sample
Rosson et al. (2016)	Aim to examine the extent to which mother-fetal bonding, substance use and mental health through pregnancy predicted postnatal mother-infant bonding at 8 weeks	Longitudinal Study	n=372 mothers	Yes and Yes	Wales, Australia	Demographic information, Birth outcomes and postnatal factors, MAAS, MPAS, Depression and Anxiety scale (DASS-21), EPDS, Quantity and frequency of substance use	Prenatal T2, Prenatal T3 and Postnatal M1	The higher antenatal bonding across all trimesters in pregnancy, predicted higher bonding to the infant 8 weeks postnatally. Symptoms of depression and stress during pregnancy are related to bonding 8 weeks postnatally. No association for substance use.	Confounding factors were taken in consideration. Valid measurements, however difficult to compare	Consistency was given. Regression analyses indicated significances properly	Somewhat advantaged study group

Rowe et al. (2013)	Aim to describe self-reported maternal-fetal emotional attachment in adolescent women over the course of pregnancy compared with adult pregnant women and identify risk factors for poor attachment	Longitudinal study	n=194 adolescents and n=184 adults were invited in which at the end n=132 adolescents and n=68 adults completed whole study. Adolescents are women below 20 years old	Yes and Yes	Melbourne Australia	Questionnaire about socio-demographic details and reproductive health, Hospital Anxiety and Depression Scale (HADS) and the Maternal Antenatal attachment scale (MAAS)	Prenatal T1, Prenatal T2 and Prenatal T3	Adolescents report slower development of antenatal emotional attachment than adults	Attrition bias could be the case. Confounding was mentioned. The MAAS was not validated for adolescents	Consistency was given, including significances. They used self-reported questionnaires	The adolescent participants received good quality of care which could have led to overestimation of quality of attachment in adolescents.	
Sanchon-Rossignol et al. (2018)	Aim to examine the association between maternal exposure to domestic violence during childhood on prenatal maternal attachment, maternal heart reactivity to an infant-crying stimulus and post-natal infant emotional regulation	Longitudinal study	n=33 mothers, n=25 mothers completed study	Yes and Yes	Geneva, Switzerland	Geneva Prenatal Stress Questionnaire; Maternal Antenatal Attachment Scale (MAAS), electrocardiogram using MONICA monitor. Infant Behaviour Questionnaire-Revised Short term version (IBQ-R-SF). Largo SES index. State trait anxiety inventory (STAI), Edinburgh Postnatal Depression Scale (EPDS), Symptom Checklist 90-revised (SCL-90-R)	Prenatal T1, Prenatal T2, Prenatal T3 and Postnatal M1, Postnatal M6	Maternal exposure to domestic violence was associated with reduced prenatal attachment of mother to fetus, increased prenatal maternal HR activity to infant-crying stimulus and poorer infant behavioural regulation	Valid measures, nothing said about bias or confounding. Mann-Whitney U test was chosen	Consistency was given. Significances were not of practical relevance due to the inadequate categories	Very small sample size. Response answers were only yes/no without any clarification for domestic violence	
Schmidt et al. (2016)	Aim to determine the predictive role of antenatal worry and depressive rumination for maternal-fetal attachment and the development of maternal depression and anxiety during pregnancy in a non-clinical sample	Longitudinal study	n=245 mothers, however final sample is n=215 mothers	Yes and Yes	Osnabruck Germany	Depression Anxiety Stress Scale (DASS), Penn State Worry Questionnaire Past Week (PSWQ-PW), Ruminative Response scale (RRS), MAAS, Social support scale (F-SozU-K-14)	Prenatal T2 and Prenatal T3	Depressive rumination during early pregnancy predicts impairments in the maternal-fetal attachment towards the end of pregnancy and that worrying during early pregnancy predicts depressive and anxious symptoms towards the end of pregnancy	Study focused on some confounding factors, but not on all possible confounding factors. Valid measures	Consistency was given and the consistency of PSWQ was unexpectedly modest	Women in sample were healthy, highly educated and in good relationships	
Smith-Nielsen et al. (2016)	Aim to examine role of personality disorder in the association between maternal postpartum depression and infant-mother attachment	Longitudinal study	n=80 participants, n=21 postpartum depression, n=59 non-clinical	Yes and Yes	Denmark	EPDS, Structured Clinical Interview for DSM-IV axis II disorders and de SSP	Postnatal M13	Postpartum depression was associated with attachment insecurity only if the mother also had a postpartum depression diagnosis	No confounding factors were included in the study,	Consistency was given	Moderate study sample, so no subgroup analysis	
Tani et al. (2018)	Aim to analyse if there is an association between pregnant women's attachment to her baby before and after birth and their relationship with their own mothers	Longitudinal study	n=201 first time mothers	Yes and Yes	Prato, Italy	Socio-demographic questionnaire, Parental bonding instrument (PBI), Prenatal attachment Inventory (PAI), Caregiving and Attachment behaviour observational form	Prenatal T3 and first 2 days after birth (M1)	Women who had positive relationships with their own mothers also had positive attachments to their unborn babies and in the period immediately after birth	Valid measures, but the observation used a binary observational form, Only the presence of maternal behaviour could be assessed and not the degree	No consistencies were given.	Only first time mothers were included with no complications, also complicated twin pregnancies could be interesting.	
Tharner et al. (2012)	Aim to investigate whether breastfeeding duration during the first 6 months is associated with maternal sensitive responsiveness, attachment security and attachment disorganization in a large prospective birth cohort	Longitudinal study	n=881 mother-infant dyads, but n=675 were fully included	Yes and yes	The Netherlands	Delivery reports of breastfeeding, Strange Situation Procedure, Family Assessment Device, Brief System Inventory	Postnatal M2, Postnatal M6 and Postnatal M14	Longer duration of breastfeeding was associated with more maternal sensitive responsiveness as well as more attachment security and less attachment disorganization.	All measures were valid. Potential confounders were mentioned. Homogeneous sample	Consistency was given. Outcome was significant only using continuous measures of attachment.	Sample was homogenous and risk factors were low	

Tharn et al. (2012)	Aim to investigate the association of maternal depressive symptoms with infant-mother attachment. Focus specifically on maternal lifetime depression and peri- and postnatal depressive symptoms.	Longitudinal study	n=989 mothers were recruited, but n=627 mothers completed study	Yes and Yes	Rotterdam, The Netherlands	Composite International Diagnostic Interview (CIDI), Brief Symptom Inventory (BSI), Edinburgh Postnatal Depression Scale (EPDS), Strange Situation procedure (SSP)	Prenatal T2, Prenatal T3, Postnatal M2 and Postnatal M14	No association of a history of clinical maternal depression and elevated maternal depressive symptoms at non-clinical levels during pregnancy and in the early postpartum period with infant-mother attachment insecurity or disorganization in a large population based sample	Valid tests, but no contributing or impeding effect was found.	Consistency was given.	High educational level and adequate family income in the current sample. Persons in this sample had easy access to professional help
Vreeswijk et al. (2014)	Aim to investigate father's experiences during pregnancy, specifically focussing on the relationship they have with their unborn child	Correlational study	n=301 expectant fathers, n=243 gave consent to conduct a home-visit participated in the semi-structured interview	Yes and Yes	The Netherlands	Internal representations of the unborn baby (WMCI) - Working Model of the Child interview, Paternal Antenatal Attachment Scale (PAAS), Edinburgh Depression Scale (EDS), State-Trait Anxiety Inventory (STAI)	Prenatal T2	Fathers who reported a higher quality of prenatal attachment were more likely to have balanced representations of their unborn children, whereas fathers with a lower quality of attachment were more likely to show disengaged representations. The quality of fathers' self-reported prenatal attachment was higher when fathers experienced fewer symptoms of depression and anxiety during pregnancy, when they were younger, and when they expected their first child.	Interview bias can occur, nothing mentioned about confounding. Design was both qualitative and quantitative using interviews and a survey (mixed methods)	Interviewers were trained to assess the interviews, reliability of measurements is high	n=243 for WMCI interview, but distribution of classifications was not equal, but this was expected. The Dutch sample was highly educated
Wynter et al. (2016)	Aim to identify factors significantly associated with self-reported father-to-infant attachment at six months postpartum, including individual factors such as personality traits and psychological well-being, infant crying and fussing and contextual sources of support	Longitudinal study	n=330 fathers completed baseline interview, n=270 completed whole study	Yes and Yes	Victoria Australia	Parental Attachment Questionnaire (PAQ), Edinburgh Postnatal Depression Scale (EPDS), Vulnerable Personality Style Questionnaire, Intimate Bonds Measure (IBM), socio-demographic characteristics	Postnatal M1 and Postnatal M6	Poorer quality father-to-infant attachment was significantly associated with personality traits like oversensitivity, more symptoms of depression and anxiety, poorer quality of partner relationship and more frequent partner criticism of infant care	Validity of the PAQ is not known for fathers, only that a new scale is published which should be used in future.	No consistencies were given for the scales. Use of telephone measures so interviewers should be adequate all the time	Only partnered men participated and they spoke English at home.

Appendix B.
Features of included intervention studies for full text analysis

Auth or	Cou ntry	Objective	Name inter- vention	Study design	Study sample (n)	Characteristics intervention	Time investment	Outcome measures	Results	Validity	Reliability	Generaliza bility	?
Blizzar d et al. (2018)	USA	Aim to examine the impact of the IBP on changes in attachment-based caregiving behaviours (warmth, sensitivity and intrusiveness) in a randomized controlled trial in which families were randomly assigned to receive the IBP or standard care	Infant behavio ur Program (IBP)	RCT	60 mother-infant dyads. IBP group n=28 and CAU group n=30, n=46 families completed whole study. Mean infants age was 13,52 months old.	The IBP is a home-based adaption of the Child-Directed Interaction (CDI) phase of the PCIT for high-risk infants and their families. Parents are taught to follow their infant's lead in play by increasing their use of behaviourally based parenting do skills and decreasing their use of behaviourally based parenting don't skills. PRIDE is used for the DO-skills (P, praise the infant, R, reflecting the infants speech, I, imitating the infants play, D, describing the infants behaviour, E, enjoyment in the play)	Postintervention of the IBP and 3 and 6 month-follow up. Sessions of the intervention took place weekly and took 1-1,5 hours. Max 7 sessions and average of 6,1 sessions per family	Early parenting Coding System (EPCS) and the Dyadic Parent-Child Interaction Coding System (DPICS)	Behaviourally based parenting skills targeted in BPT programmes have a broader impact on important attachment-based caregiving behaviours during the critical developmental period from infancy to toddlerhood	Caregiving behaviours were related to parent-child attachment, but attachment was not measured. Nothing about Confounding/ bias	Kappa's of the outcome measures were given. SEM was chosen and explained	Homogeneous study sample (ethnicity and SES), participants were rewarded by participation	
Macdo nald et al. (2018)	North ern Irelan d	Aim to determine whether the New Baby Programme, compared with routine antenatal and postnatal care, can improve infant attachment and maternal sensitivity among pregnant women with complex social factors and the quality of maternal-child relationships	New Baby Program me (NBP)	RCT Protoco l	Aim to recruit 50 women and randomize equally. Risk population: mothers with social isolation/ low family support / father in prison, intimate partner violence, substance misuse, maternal stress or mental health problems, current involvement with social services, history of care or care leaver, abnormal reaction to pregnancy	The NBP aims to promote mental health and well-being in pregnancy, maximise secure attachments and enhance sensitive parenting and infant cognitive development. Goals were to improve the birth outcomes, to promote secure attachments and to promote child health and development.(1) Improve birth outcomes (prenatal): mother related to reduce stress reduce substance use, increase positive health behaviours, increase coping strategies, improve physical and mental health, increase informal support and increase professional/service support --> for infant: born >37 weeks gestation and reduced admission to NICU. (2) promote secure attachments and promote child health and development: for the child: securely attached, good developmental outcomes --> mother: breastfeeds, sensitive and responsible caregiving and connecting to community or other services	Measurements are at baseline (prenatal T2) and Postnatal M2, M6 and M12. Health visitors are performing home visits every month after baseline. Weekly home visits from birth till M2 and fortnightly visits till the infant is M5 and monthly visits till the infant is M24	Strange Situation (SSP), Infant CARE Index (ICI), Edinburgh Postnatal Depression Scale (EPDS), The Revised Prenatal Distress Questionnaire (NUPDQ), Strait Trait Anxiety Inventory (STAI-6), Aberdeen Parenting Stress Index Short Form (ASI-4-SF), questions about smoking, alcohol, drug and relationship violence, Parenting Sense of Competence (PSOC), Maternal Health related quality of life (EuroQol EQ-5D-5L), Medical Outcomes Study Social Support (MOS), Child development Mullen Scales of Early Learning	No result yet, because it is a pilot study	Blinding was taken into account. Outcome assessors are asked to record any indication and will count as potential bias.	Most of the consistencies were given. Because it is a pilot no significances.	Participants were rewarded for each time they participated.	
O'Neill et al. (2018)	Canad a	Aim to assess the effectiveness of 'Make the Connection' (MTC), an attachment-focussed parenting programme in fostering maternal attitudes thought to underlie sensitive responding	Make the Connect ion (MTC)	Control led trial	180 mothers with infants aged 3 to 8 months. All participants were 'at risk' of first-time parent, socially isolated, low education, less than 25 years old, parenting alone, lacks confidence, poor infant sensitivity, postpartum depression	MTC aims to improve paternal attitudes through activities designed to enhance the parent's ability to take the baby's perspective and understand infant communication, with the ultimate goal of establishing felt security for the infant. MTC takes a behavioural orientation and each session includes three segments: parent and baby time, parent discussion and videotaping/refreshments. (1) Parent-baby time: parents interact with their infant through guided activities and reflect on their responses. (2) Parent discussions: discussion about parents' own experiences and those of the infant. (3) Videotaping: parents are videotaped with their infants and socialize. These are all group sessions containing 8-10 parents.	MTC contains of nine 90-minute weekly sessions	Maternal Postnatal Attachment Scale (MPAS), Parent sense of competence questionnaire (PSOC).	Make the Connection, as delivered to at-risk mothers by a large public health agency in Canada, is effective in improving maternal attitudes thought to underlie sensitive responding.	Not a RCT because of the sample of infant age. Nothing said about confounding/ bias.	Reliability not explicitly mentioned. PSOC is known for mixed reliability/valid ity among samples	Low SES mothers are underrepresent ed (research team proposes a reward next time to include every mother at risk). Program is for parents but only mothers participated	
Svanbe rg et al. (2010)	Engla nd	Aim to report details about the development, implementation and evaluation of a clinical programme that used a targeted prevention approach following a universally-offered	Sunderla nd Infant Program me	Control led trial	Intervention group at baseline consisted of 241 mother-infant dyads, however only 134 dyads completed entire intervention. Control group consisted of 82 dyads however 58 completed the control group. In	Aim of the Sunderland Infant programme was to increase the proportion of securely attached children within a sample of families receiving services through England's universal Sure Start programme(government funded). The CARE-Index was used for measure of maternal sensitivity. Three groups were made (high risk, struggling and sensitive enough) and received different	2 weeks Postpartum information was given, Six weeks postnatal consent form, 8-12 weeks postnatal videotape for CARE-index. Resulted in three groups (high risk, struggling and sensitive enough)	Edinburgh Postnatal Depression Scale (EPDS), Rosenberg Self-esteem Questionnaire, Goldberg and Williams General Health Questionnaire (GHQ-12), Parenting Stress Index (PSI), CARE-Index, Strange Situation procedure (SSP) and the Service Utilisation Questionnaire	Improved maternal sensitivity in the intervention condition compared to comparison. Infants in intervention were significantly more likely to be classified as securely attached.	Infant-mother attachment was assessed based on the SSP. Coding bias happened because clinical service personnel were also the	Reliability of CARE-Index was mentioned. Significances mentioned for index's	High attrition rate. Follow-up with SSP was completed by a small group due to transportation issues.	

		screening of parent-infant interactions			total 192 mother-infant dyads in this study	interventions. 1. Sensitive enough: one visit to provide positive feedback based on the videotape. Struggling and high risk: intervention was tailored based on specific dyads. 2. Struggling: four reflective video feedback sessions (topics: develop mindfulness, acknowledging ambivalence, mothers own childhood and impact of separations. 3. High risk: received four video feedback sessions + psychotherapy				evaluators of the study		
Thoma s et al. (2014)	Melbo rne, Austra lia	Aim to examine the acceptability and effectiveness of an antenatal group intervention designed to reduce the severity of depression and anxiety symptoms and improve maternal attachment in pregnant women with current/emerging depressions	Antenat al group program	Pretest- Posttest longitu dinal design	Total of 48 expectant mothers participated in the intervention and n=37 completed at least 80%. Risk group for mental health problems (depression and anxiety)	An antenatal group program designed to reduce the severity of depression and anxiety symptoms and improving maternal attachment in pregnant women with current or emerging depression and anxiety. Sessions consisted of four components: several behavioural self-care strategies, psycho-educational component, interpersonal therapy (IPT), parent-infant component addressing infant attachment needs.	Six two hour sessions every two weeks including two sessions of mothers and partners.	Centre of Epidemiological Studies Depression Scale (CES-D), Edinburgh Postnatal Depression Scale (EPDS), Strait Trait Anxiety Inventory (STAI), Maternal Antenatal Attachment Scale (MAAS), Client satisfaction Questionnaire (CSQ-8)	Significant improvements with moderate and large effect sizes were observed for depression, state anxiety and maternal attachment.	Not an RCT, so no comparisons with a control group.	Reliable measurement instruments	Inclusion of fathers is good as well as mothers, small study sample (high attrition rate)
Torres et al. (2011)	Spain	Aim to develop and implement a group-intervention aimed at promoting secure attachment of children in Spain.	Group intervent ion	Control led Trial	Total of 24 pregnant women in the T3 agreed to join the study and 16 women in intervention group and 8 women in control group	Group intervention about infant-mother attachment. Started with AAI and 22 sessions during prenatal and postnatal phase. Sessions consisted of elements such as self-knowledge and well-being of parents, relevance of own child rearing experience, healthy development of the first year of the infant, parents' mental representations, importance of partner relationship, role of the father, infant temperament	Six prenatal sessions on a weekly basis and 16 postnatal sessions on two-weekly or monthly basis (22 sessions in total) and a baseline AAI and follow-up SSP.	Socio-demographic questionnaire, Adult attachment interview (AAI), Strange Situation (SSP).	A successful easy-to-implement and inexpensive group intervention of a preventive nature could be useful in enhancing the quality of infant-mother attachment	Lack of randomization	No consistencies of the measurement instruments were given	Small study sample
Sander s (1999)	Brisba ne, Austra lia	Aim to describe the conceptual and empirical foundations of a comprehensive multilevel model of parenting and family support, which aims to better equip parents in their childrearing role	Triple P- Positive Parentin g Program	Multipl e RCTs were conduc ted	Theoretical and empirical foundations, so no actual RCT study	The program aims to prevent severe behavioural, emotional, and developmental problems in children by enhancing the knowledge, skills and confidence of parents. It incorporates five levels of intervention on a tiered continuum of increasing strength (based on the severity of the problems). These interventions include a universal; population-level media information campaign for all parents, two levels of brief primary care consultations targeting mild behavioural problems, and two more intensive parent training and family intervention programs for children at risk for more severe behavioural problems	(1) Media strategy; (2) Selective triple P, one session 20 min; (3) 4-session 20-min information based strategy (4) Standard triple P, 10 sessions of 90 min each, Group triple P (8 sessions, 4 2hour group sessions and 4 telephone calls) Self-directed triple P, weekly 15-30min phone calls, (5) enhanced triple P, 9 sessions of 90 min each	Not mentioned in this report	Encouraging evidence that Triple P is an effective parenting strategy based on 5 criteria: (1) replicability of findings, (2) clinically meaningful outcomes for families, (3) effectiveness of different levels of intervention, (4) consumer acceptability and (5) Effectiveness with a range of family types	Effectiveness was not explicitly mentioned, but it was said that the Triple P program was effective and efficient. Attachment was not explicitly measured. Program consisted of multiple determinants	No conclusion could be given about the exact replicability of the findings	Tested in Australia and in Germany of parents of infants till the age of 12
Evans et al. (2017)	Austra lia	Aim to evaluate the effects of the parenting intervention Baby Triple P (BTP) for parents' of very preterm infants (<32 weeks of gestational age), on the quality of the mother-infant relationship and a mother's attachment and responsiveness to her infant at 6weeks and 12weeks corrected age	Baby Triple P	RCT	120 families were recruited with a total of 145 infants. Groups were randomised and 61 families were in the BTP group and 59 families in the CAU group. Out of the BTP group 41 families received the entire intervention	Baby Triple P aims to enhance the knowledge, confidence and skills of expectant and new parents of infants born at term. Parents received four sessions when they were in the hospital: session 1 consisted of survival skills. 2. partner support. 3. Positive parenting and 4. Responding to your baby	Four two hour in hospital sessions and four 30 min telephone consultations and follow-up at six weeks and 12 months	Trial entry form, Family background Questionnaire (FBQ), Emotional availability scale (EA scale), Maternal postnatal attachment scale (MPAS), Maternal Infant Responsiveness Instrument (MIRI)	The study found no evidence that BTP improved the quality of the mother-very preterm infant relationship, maternal attachment or responsiveness at 6 weeks corrected-age or 12 months corrected age. For maternal attachment at 12 months corrected age, the CAU group scored significantly higher.	Nothing said about possible confounding factors. Results were not expected, because the intervention did not work as it should. Reasons of why this could happen were mentioned	Consistencies were given and are reliable. Linear regression analysis was performed	Sample size started off great but few families finished the intervention. The CAU had a significantly younger age and more first time mothers

Mihelic et al. (2018)	Australia	Aim to evaluate the effects of a parenting intervention (Baby Triple P) on fathers who were experiencing their first baby	Baby Triple P	RCT	112 fathers expecting their first baby. N=57 were allocated to the intervention and n=55 were allocated to CAU. At 6 months post birth n=43 completed assessment of the intervention group. Mothers were recruited and were at risk for unplanned pregnancy/low education//SES/ low relationship satisfaction/ low social support/depression/ between 18 and 21 years old	Baby Triple P is an intervention for both mothers and fathers that targets the key risk factor for poor child developmental outcomes identified in early infancy (i.e. parental mental health, couple adjustment and parenting confidence and skills)	Intervention consisted of four two hour sessions during the prenatal phase and four telephone sessions of 30 min when the baby was 6 weeks old and measurements at 10 weeks postnatal and 12 months postnatal	Edinburgh Postnatal Depression Scale (EPDS), Depression Anxiety Stress scale (DASS), Oxford happiness questionnaire (OHQ), Maternal self-efficacy scale (MSES), Couple relationship with subset of the Parenting and Family Adjustment Scale (PAFAS), Maternal Infant Responsiveness Instrument (MIRI), Postpartum bonding instrument (PBI), Client satisfaction questionnaire	This study did not find any significant intervention effects on any of the measured outcomes. The results indicate no conclusive evidence for the effectiveness of baby triple P for new fathers	Attrition of fathers was very low, maybe not suitable intervention looking at the three domains of personal wellbeing, parenting and couple relationship. No bias or confounding were mentioned	Consistencies were given and reliable.	Low number of fathers participated in each session of the BTP training or during the phone calls.
Mihelic et al. (2018)	Australia	Aim to experimentally test the hypothesis that provision of parenting support at the transition to parenthood through Baby Triple P will lead to improvements in parental confidence and sense of competence in their abilities as parents	Baby Triple P	RCT Protocol	Approximately 110 couples, so n=110 mothers and n=110 fathers. At risk for unplanned pregnancy/ low education/ low income/ low relationship satisfaction/ low social support/ history of depression/ current depression or anxiety/ low parenting efficacy/ low life satisfaction/ aged 18-21	Baby Triple P is a psychological parenting intervention aimed to prepare new parents for a positive transition to parenthood by teaching them skills in the domains of parenting their baby, looking after their own well-being, as well as maintaining a positive relationship with their partner. Unique aspect of the self-regulatory framework and active skills training to enhance self-efficacy and encourage parents to generalize their learnt skills to when their child is order or to other areas and times of their lives. Both parents and infants were educated in parenting strategies, individual coping skills and partner support skills	Intervention consisted of four two hour sessions during the prenatal phase and four telephone sessions of 30 min when the baby was 6 weeks old and postnatal visits of 10 weeks and 6 months	Family background questionnaire (FBQ), Cambridge worry scale (CWS), Maternal self-report inventory, Maternal self-efficacy questionnaire (MSES), Edinburgh Postnatal depression scale (EPDS), Depression, Anxiety and Stress Scale (DASS), Oxford happiness questionnaire (OHQ), Prenatal maternal Expectations Scale (PMES), Social support scale, Couple relationship with subset of Parenting and Family Adjustment Scale (PAFAS) and Household and Childcare task checklist (HCTC), Maternal Infant responsiveness inventory (MIRI), The Care Index, Postpartum bonding instrument (PBI), Baby behaviour inventory (BBI), Baby diary, Conflicting Advice Questionnaire and Problem Solving and Client satisfaction scale	No result yet, because it is a protocol for a study	Self-reported questionnaires, affected probably by social biases.	Consistencies were given of every measurement scale. To assess the couple relationship subsets of questionnaires were used and it was unknown of this is applicable or not	Couples have to meet at least two of the risk factors.
Hoffman et al. (2006)	USA	Aim to assess the effectiveness of a new group-based intervention protocol, Circle of Security, which was developed by drawing on the dynamics of secure and insecure attachment patterns	Circle of Security (COS)	Pretest-Posttest longitudinal design	75 dyads began the intervention phase and 65 dyads completed Children were between 11-58 months old (mean=21months) Participants lived below poverty line, in violent neighbourhoods and experienced own childhood maltreatment or trauma	COS contains both educational and therapeutic components. Five goals of the protocol are: 1. establish the therapist and group as a secure base in which the caregiver can explore the relationship with the child. 2. Increase caregiver sensitivity and responsiveness. 3. increase caregiver capacity to recognize and understand cues of children. 4. increase caregiver empathy and 5. increase caregiver reflection. These were all group sessions	Intervention consisted of 20 sessions during every week lasted about 75 min (group-intervention)	Strange Situation (SSP), MacArthur Preschool Strange Situation, Circle of Security Interview, Parent development Interview and the Adult attachment interview	COS is a promising intervention for the reduction of disorganized and insecure attachment in high risk toddlers and pre-schoolers	Lack of experimental control group with a randomized assessment	Strange Situation is still the golden standard for assessing attachment with good consistencies (however not mentioned)	Larger study ample would have been better
Ramsauer et al. (2014)	Germany	Aim to evaluate the efficacy of the COS intervention for mentally ill mothers with infants, for the first time in Germany and in a clinical context	Circle of Security (COS)	RCT Protocol	80 mother-infant dyads. Infants are then 4-9 months old. Mothers were mentally ill	COS was designed to alter developmental pathways for at risk parents and their children. Group intervention focuses on the caregiver and his relational capacities in providing child-parent attachment security	Intervention consisted of 20 sessions during every week that lasted about 90 min. Plus one session of 120 min with family	Strange Situation, mini-Maternal Behaviour Q-Sort, Disconnected and extremely Insensitive Parenting rating procedure (DIP), Adult attachment Interview (AAI), Reflective Functioning (RF), Parental Reflective Functioning Questionnaire (PRFQ), Structured Clinical Interview (SCID-1), SCID-2, Beck Depression Inventory (BDI), Symptom checklist by Derogatis (SCL-90-R), Parenting Stress Index (PSI), Difficulties in Emotion Regulation Scale (DERS), Child Behaviour Checklist (CBCL)	Protocol, so no result yet	Bias of the implementor who was also the principle investigator.	Mental health problems could be wide, nothing was said about the specific mental health issues of the women	Study sample, possibility of sample bias

Skovgaard Vaever et al. (2016)	Denmark	Aim to determine whether COS-P as an indicated short group-based educational intervention can lead to	Circle of Security Parenting (COS-P)	RCT Protocol	314 eligible families will be randomly be allocated with a ratio of 2:1 into the COS-P intervention or into the CAU. Mother is screened positive for symptoms of depression	The COS-P manual and video material had been translated to Danish and based on this material, parents are trained to see and understand infant attachment behaviour and especially to learn about infant miscuing attachment signals. Both mother and partner are invited to participate in the group sessions and each group includes 5-7 families	Intervention consisted of 10 sessions during every week and lasted about 90 min	Coding Interactive behaviour (CIB), Strange Situation procedure (SSP), Alarm Distress Baby Scale (ADBS), Paternal reflective functioning questionnaire (PRFQ-1), Parenting Stress Index (PSI), Ages and Stages Questionnaire - Social-Emotional (ASQ-SE), Bayley Scales of Infant and Toddler Development 3th edition-Screening test (BSID-3), Edinburgh Postnatal Depression Scale (EPDS), Structured Clinical Interview for DSM-5 Disorders - Research version (SCID-5-RV), Hopkins Symptom checklist (SCL-92), Experience in close relationships (ECR-R), McMaster family functioning device (FAD), Strate Trait anxiety questionnaire (STAI), Standardized Assessment of Personality (SAPAS), Family and Social support scale (FSS)	Protocol, so no result yet	Short version of COS should be validated as well. Nothing said about confounding or bias	Consistencies of all measurement instruments were given	Study sample had to be big, group assessments with mothers with depression could be challenging
Ericks on and Egelan d (2004)	USA	Aim to discuss the theory that has guided the research, summarise critical findings from 29years and illustrate how this research has been used to inform and shape preventive intervention for parents and infants in high-risk circumstances	Steps Towards Effective and Enjoyable parenting	RCT	First time low-income mothers of children 0-23 months old	The overall goals of STEEP are to improve parental knowledge and understanding of child's behaviour and development. Improve parental sensitivity and responsiveness to infant cues, improve parental coping skills and decision making related to life-planning for themselves and their child. Strengthen the family support network, including both formal and informal resources and to improve parents' reflective capacity as it relates to how their relationship history influences their responses to their child	27 months (beginning in T2 and continue till M24). Bi-weekly home-visits that continued till the infant is two years old. Mothers also attend bi-weekly group sessions with other mothers	Not mentioned in this report	Not mentioned in this report	Report	Report	Report
Suess et al. (2016)	Germany	Aim to replicate and contribute to evidence regarding the effectiveness of the STEEP intervention	Steps Towards Effective and Enjoyable parenting	Pretest-Posttest longitudinal design	78 mother-infant dyads in intervention group and 29 mother-infant dyads in control group. Mothers were at risk for neglect and abuse. Very young mothers. There was a major loss of data due to drop out and missing values	STEPP main goal besides keeping the baby safe was to support the development of secure infant-parent attachment by (1) enhancing maternal sensitivity by using video feedback (Seeing is believing), (2) addressing maternal attachment representations by encouraging mothers to explore past and current relationship experiences and their influence on parenting (looking back moving forward) (3) promoting the development of effective social support through bi-weekly individual visits and mother-child group experiences beginning during pregnancy till the child's second birthday	Two year intervention program	Strange Situation Procedure (SSP), Attachment Q-sort (AQS), Parental Stress Index Short form (PSI-SF), Adult/Adolescent Parenting Inventory (API), Edinburgh postnatal depression scale (EPDS), Risk exposure	The STEEP group shows significantly fewer signs of attachment disorganization than in the control group after 24 months	No randomized controlled trial.	Measurement instruments were valid and reliable but not known for this age group	Age group was young. Control group is small

