

Review

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[Nidhi Jithesh](#)*

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Review

Maternal Behavioral Patterns and Their Impact on Fetal Development Trajectories

Nidhi Jithesh

Jain University School Of Allied Healthcare And Sciences; nidhijithesh487@gmail.com

Abstract: Poor perinatal mental health can have significant and lasting impacts on a woman's overall health and the well-being of her children and family. From conception, a baby's behavior, appearance, aversions, and interests can be influenced by the prenatal environment. Thus, the quality of prenatal care is crucial. Factors such as maternal stress, environmental conditions, cravings, mood swings, hormonal changes, and emotional experiences during pregnancy can profoundly affect the baby's behavior once born. The baby's interaction with the external world begins from conception, not just at birth. For instance, maternal depression can negatively affect both the mental and physical health of the infant. Therefore, fostering a supportive environment for expectant mothers is essential for their health and that of their unborn child. Promoting the mother's well-being through happiness and comfort is critical. This review paper aims to synthesize current research on maternal-fetal attachment during pregnancy, its evolution, and its postpartum effects on the mother-infant relationship. It will explore how these dynamics change over time, both during pregnancy and after delivery, to provide a comprehensive understanding of the factors influencing attachment and related outcomes. As Alan Soufre, a famous developmental psychologist would state, "Attachment would begin before birth. The mother's emotional state can shape the child's development trajectory long before the child is born".

Keywords: perinatal mental health; maternal-fetal attachment; maternal depression

1. Introduction

Attachment, traditionally viewed as a set of internal behaviors fostering a close bond between an infant and their primary caregiver which in most cases is the mother, was initially considered relevant only in the post-partum period. However, recent research suggests that this attachment process begins well before birth, during pregnancy. Evidence indicates that various factors, such as nationality, cultural background, mental and social conditions, and an individual's past experiences, can influence this attachment. For example, women who did not experience secure attachments during childhood may encounter difficulties in forming a strong bond with their infants. Attachment theory, introduced by John Bowlby in the 1960s, defines attachment as "a set of internal behaviors that cause the infant to become closely related to his or her main caregiver, usually the mother." While much research has concentrated on postpartum mother-infant interactions, there is a notable gap in understanding how parents perceive and form attachments to their fetus during pregnancy. Most studies on prenatal attachment are cross-sectional and primarily focus on the third trimester, leaving a gap in the understanding of maternal-fetal attachment throughout pregnancy. Given that maternal behaviors, actions, and thoughts during pregnancy can have enduring effects on the fetus, it is essential to examine attachment more comprehensively throughout the entire pregnancy. Limited-time studies cannot provide a complete picture of the factors and outcomes associated with maternal-fetal attachment. Research indicates that this relationship can be influenced by cultural norms, mental health, and personal history. For instance, women with insecure attachment histories may struggle to form a connection with their fetus. Moreover, the impact of maternal mental health on fetal and infant development is a significant area of study. Psychiatric disorders during pregnancy are known to affect both fetal and infant health outcomes. Given the critical role of attachment in child development and maternal health, and the current lack of detailed information in this area, this review aims to evaluate maternal-fetal attachment during pregnancy and its postpartum consequences on the mother-infant relationship. This review will analyze attachment dynamics both during pregnancy and after

delivery to understand how related factors and changes in attachment evolve over time. By increasing awareness of prenatal attachment, this research will contribute to improving maternal and infant health outcomes and aid in the development of targeted interventions to strengthen the maternal-fetal bond.

2. Review of Literature

2.1. Maternal-Foetal Bonding in Iran

Vajihe Atashi, Shahnaz Kohan, Zahra Salehi, and Kobra Salehi (2018) examined the impact of Maternal-foetal emotional relationship during pregnancy, its related factors and outcomes in Iranian pregnant women. The context highlights the importance of longitudinal research in understanding the evolution of the mother-infant relationship and its impact on the child's emotional, social, and behavioral development. The study aims to provide insights into how maternal attachment during pregnancy influences the child's development and the mother's transition into maternal identity.

2.1.1. Rationale

The necessity for longitudinal data is emphasized, as cross-sectional studies or single data collection episodes do not capture the dynamic nature of the mother-infant relationship over time. The context discusses the potential negative outcomes of inappropriate attachment development, including emotional and behavioral issues in childhood and adolescence, as well as tendencies toward substance abuse in adulthood. These points underscore the need for comprehensive studies that track these relationships over time.

2.1.2. Methodology

- *Study Design:* Longitudinal panel study.
- *Participants:* Pregnant women in their first trimester (gestational age < 13 weeks).
- *Data Collection:*
 - Initial Phase: Data collection begins in the first trimester, with demographic and reproductive characteristics recorded, followed by assessments using the Beck Depression Inventory (BDI) and Spielberger State-Trait Anxiety Inventory (SSTAI). If time permits, additional assessments such as the Social Support Appraisal (SSA), Adult Attachment Scale (AAS), and Parental Bonding Instrument (PBI) are administered.
 - Second Trimester: The BDI and SSTAI are reassessed, and the Cranley's Maternal-Fetal Attachment Scale (CMFAS) is introduced after the mother feels fetal movement.
 - Third Trimester: The same questionnaires used in the second trimester are administered again.
 - Follow-up: Data collection continues at multiple points post-delivery, specifically during the first visit after birth, and at two, four, and six months later.

2.1.3. Significance

The study is crucial in understanding the mother-infant relationship's trajectory and its implications for both maternal and child well-being. It also contributes to identifying potential early interventions that could prevent negative developmental outcomes in children.

2.1.4. Strengths

- *Longitudinal Design:* The study's longitudinal approach allows for a comprehensive analysis of the evolving relationship between mother and child, capturing data at critical stages during pregnancy and early postpartum.
- *Multiple Assessment Tools:* The use of various validated tools, such as BDI, SSTAI, SSA, AAS, PBI, and CMFAS, strengthens the study's ability to assess different dimensions of maternal attachment and psychological well-being.

2.1.5. Limitations

- *Participant Retention*: Longitudinal studies often face challenges related to participant retention over time, which could affect the study's outcomes.
- *Time and Resource Intensive*: The study requires significant time and resources to follow participants through multiple stages of pregnancy and postpartum.

2.1.6. Conclusion

This study provides valuable insights into the development of maternal attachment and its impact on child development. The structured approach and use of multiple assessment tools offer a robust framework for understanding these complex relationships over time. Further research, particularly in diverse populations, could enhance the generalizability of the findings and contribute to better maternal and child health outcomes.

2.2. *Pregnancy Intent and Bonding*

Karina M. Shreffler, Ph.D., Tiffany N. Spierling, Ph.D., Jens E. Jespersen, M.S., and Stacy Tiemeyer, Ph.D. (2021) studied about the Pregnancy Intendedness, Maternal-Foetal Bonding, and Postnatal Maternal-Infant Bonding. The study employs a longitudinal design, tracking participants from their first prenatal visit through the first month postpartum. This approach allows for a detailed examination of how prenatal bonding and pregnancy intendedness affect maternal-infant bonding after birth.

2.2.1. Study Overview

The study explores the relationships between pregnancy intendedness, prenatal maternal-fetal bonding (MFB), and postnatal maternal-infant bonding. Given the substantial proportion of unintended pregnancies in the U.S., this research is crucial for understanding how these factors impact maternal and child well-being.

2.2.2. Research Objectives and Design

The study employs a longitudinal design, tracking participants from their first prenatal visit through the first month postpartum. This approach allows for a detailed examination of how prenatal bonding and pregnancy intendedness affect maternal-infant bonding after birth. By using multiple regression analyses, the study investigates direct associations and interactions between these variables.

2.2.3. Key Findings

- *Impact of Pregnancy Intendedness*: The results confirm that unintended or unwanted pregnancies are linked to lower levels of maternal-infant bonding post-birth. This finding aligns with existing research that suggests unintended pregnancies can disrupt maternal-infant relationships, leading to adverse long-term outcomes for both the mother and child.
- *Role of Prenatal Maternal-Fetal Bonding*: The study demonstrates that higher levels of prenatal MFB are associated with better postnatal maternal-infant bonding. This supports the idea that prenatal bonding has a significant, positive effect on the mother-infant relationship after birth.
- *Protective Effect of Prenatal Bonding*: Notably, the study finds that prenatal MFB can buffer the negative effects of unintended pregnancies on postnatal bonding. For women who reported their pregnancies as unintended or unwanted, higher levels of prenatal bonding were associated with better postnatal bonding outcomes. This suggests that enhancing prenatal bonding could mitigate some risks associated with unintended pregnancies.

2.2.4. Methodological Strengths

- *Longitudinal Approach*: The use of a longitudinal design is a significant strength, as it provides a temporal perspective on how bonding evolves and how prenatal experiences influence postnatal outcomes. This approach helps overcome recall bias, offering a more accurate assessment of the relationships between pregnancy intendedness, prenatal bonding, and postnatal bonding.

- *Comprehensive Data Collection:* The study's data collection at multiple points during pregnancy and postpartum allows for a detailed analysis of the factors affecting maternal-infant bonding. This comprehensive approach enhances the reliability of the findings.

2.2.5. Areas for Improvement

- *Sample Diversity:* The review notes that the sample includes a significant proportion of women from a metropolitan city in the South-Central U.S. and mentions that scores were lower among Black women. More information on how the sample's socio-demographic characteristics might influence the findings would be beneficial. Including a more diverse sample could provide a broader perspective on the generalizability of the results.
- *Absence of Significant Association Between Intendedness and MFB:* The study finds no significant direct relationship between pregnancy intendedness and MFB, which might seem counterintuitive given the known impacts of intendedness on maternal experiences. Further investigation into this aspect could clarify whether other unexamined variables might be influencing this relationship.
- *Intervention Strategies:* While the study identifies prenatal bonding as a promising target for intervention, it would be helpful to detail specific intervention strategies or programs that could be implemented to enhance prenatal bonding. Additionally, exploring how these interventions might be tailored to different populations or levels of unintendedness could provide practical insights for improving maternal and child health.

2.2.6. Conclusion

Overall, the study makes a valuable contribution to understanding how prenatal and postnatal bonding are interconnected and how prenatal MFB can act as a protective factor for women with unintended pregnancies. By employing a robust longitudinal design and highlighting the potential for interventions, the research provides actionable insights into mitigating the adverse effects associated with unintended pregnancies. However, addressing the sample's diversity and further exploring the nuances of the intendedness-MFB relationship could enhance the study's applicability and impact.

2.3. Maternal Coherence and Attachment

Moksha Pasricha, Suhaavi Kochhar, Ashumi Shah, and Avantika Bhatia (2021) had examined the Sense of Coherence, Social Support, Maternal-Fetal Attachment, and Antenatal Mental Health: A Survey of Expecting Mothers in Urban India. This study investigates the relationships between expecting mothers' sense of coherence, perceived social support, and maternal-fetal attachment in relation to their mental health outcomes in urban India. Given the significant psychological, physiological, and social changes during pregnancy, this research is crucial, particularly in developing countries where antenatal mental health is often under-researched.

2.3.1. Research Objectives and Design

The primary objective is to understand how psychosocial factors affect antenatal mental health. The study employs a cross-sectional design, utilizing online surveys to collect data on maternal-fetal attachment, sense of coherence, perceived social support, and their associations with antenatal well-being and depressive symptoms.

2.3.2. Key Findings

- *Associations with Antenatal Depression:* The study finds that sense of coherence and perceived social support are negatively associated with antenatal depression, aligning with existing literature that highlights the protective role of these factors against depressive symptoms. Maternal-fetal attachment, while positively related to psychological well-being, does not uniquely contribute to the variance in antenatal depression.

- *Influence on Well-Being:* Both maternal-fetal attachment and sense of coherence are positively associated with antenatal well-being. The results show that sense of coherence and maternal-fetal attachment uniquely contribute to variance in well-being scores, suggesting that these factors play a crucial role in enhancing overall antenatal mental health.
- *Perceived Social Support:* High levels of perceived social support are associated with lower levels of depression and higher well-being. The study theorizes that greater social support may help expecting mothers maintain a higher sense of coherence, which in turn contributes to better mental health outcomes.

2.3.3. Methodological Strengths

- *Innovative Focus:* This study is notable for its focus on psychosocial factors in an Indian context, which is relatively underexplored. The integration of sense of coherence, maternal-fetal attachment, and perceived social support into a single study provides a comprehensive view of these factors' influence on antenatal mental health.
- *Online Data Collection:* Using online surveys allows for a broad reach and convenience in data collection. This approach is particularly useful in urban settings where internet access is prevalent.

2.3.4. Areas for Improvement

- *Cross-Sectional Design:* The cross-sectional nature of the study limits the ability to draw causal inferences. Longitudinal studies would provide more insight into how these psychosocial factors evolve over time and their causal relationships with mental health outcomes.
- *Sample Bias:* The sample may not be fully representative of the broader Indian population due to self-selection bias and socio-economic homogeneity. Future research should aim for a more diverse sample to improve generalizability.
- *Self-Report Measures:* Data collected through self-report questionnaires may introduce biases based on participants' subjective perceptions. Incorporating objective measures or multiple data sources could provide a more comprehensive assessment of antenatal mental health.

2.3.5. Implications for Practice and Research

- *Clinical Practice:* The findings underscore the importance of addressing psychosocial factors such as perceived social support and sense of coherence in antenatal care. Interventions aimed at enhancing these factors could improve mental health outcomes for expecting mothers.
- *Future Research:* Further studies should utilize longitudinal designs to better understand the causal relationships between psychosocial factors and antenatal mental health. Additionally, expanding research to include diverse populations and incorporating both subjective and objective measures will enrich the understanding of antenatal mental health in different contexts.

2.3.6. Conclusion

This study makes a significant contribution by examining the interplay between sense of coherence, maternal-fetal attachment, and perceived social support in relation to antenatal mental health in urban India. While the findings largely support existing theories and highlight the importance of these psychosocial factors, addressing the methodological limitations and expanding research to more diverse and longitudinal contexts will be essential for a deeper understanding and more effective interventions.

2.4. Maternal Well-Being and Attachment

Josephine McNamara, Michelle L. Townsend, and Jane S. Herbert (2019) focused on A systematic review of maternal well being and its relationship with maternal fetal attachment and early postpartum bonding. The systematic review investigates the relationship between maternal psychological wellbeing and maternal-fetal attachment (MFA), as well as early postpartum bonding. The review

highlights the complex interplay between psychological factors and attachment/bonding processes, reflecting on the gaps in theoretical frameworks and inconsistencies in study methodologies.

2.4.1. Strengths

- *Comprehensive Approach:* The review follows the PRISMA guidelines, ensuring a thorough and systematic approach to literature synthesis. The inclusion of multiple databases and the broad search strategy provide a robust foundation for the review.
- *Focus on Critical Periods:* By examining both the antenatal and early postpartum periods, the review offers valuable insights into how maternal psychological wellbeing impacts MFA and bonding over time. This longitudinal perspective is crucial for understanding the dynamic nature of these relationships.
- *Detailed Analysis of Variables:* The review breaks down the impact of various psychological factors—depression, anxiety, stress, and social support—on MFA and postpartum bonding. This detailed analysis helps clarify how specific aspects of maternal mental health influence attachment and bonding.
- *Identification of Gaps:* The review effectively identifies key gaps in the literature, such as the lack of a unified theoretical framework for MFA and inconsistencies in how maternal mental health is measured. Highlighting these gaps is important for guiding future research.

2.4.2. Weakness

- *Inconsistent Findings:* The review reveals substantial variability in study findings regarding the relationship between maternal mental health and MFA. This inconsistency, coupled with varied methodologies and definitions, underscores the need for standardization in future research.
- *Reliance on Self-Report Data:* The heavy reliance on self-report questionnaires, while practical, may introduce biases and limit the reliability of the findings. Incorporating clinical assessments and validated screening tools could strengthen the conclusions drawn.
- *Limited Focus on Certain Variables:* While the review covers a range of psychological factors, some relevant domains like body dissatisfaction and disordered eating are underexplored, particularly in relation to postpartum bonding.
- *Lack of Standardized Data Collection:* The absence of standardized data collection points across studies may lead to overgeneralization of results. Consistent data collection intervals could improve the accuracy and comparability of findings.

2.4.3. Recommendations

- *Develop Theoretical Frameworks:* Future research should focus on developing and validating comprehensive theoretical frameworks for MFA that can accommodate its multi-dimensional nature and guide consistent measurement.
- *Standardize Measurements:* The field would benefit from standardized, validated tools for assessing maternal mental health and MFA, including clinical diagnostic measures to complement self-report data.
- *Broaden Research Scope:* Further studies should explore additional variables such as body dissatisfaction and disordered eating in relation to both MFA and postpartum bonding to provide a more holistic understanding of maternal mental health.
- *Implement Longitudinal Studies:* To better capture the fluid nature of pregnancy and postpartum periods, longitudinal studies with consistent data collection points should be conducted. This approach will help in understanding the continuity and changes in MFA and bonding over time.

2.4.4. Conclusion

This systematic review provides valuable insights into the relationship between maternal psychological wellbeing, MFA, and postpartum bonding. Despite its strengths, such as a comprehensive approach and identification of critical gaps, the review also highlights significant inconsistencies and

methodological limitations. Addressing these issues in future research will enhance our understanding and support better clinical practices for improving maternal and infant health outcomes.

2.5. *Infant Development: Impact of Maternal Factors*

Grace Branjerdporn, Pamela Meredith, Trish Wilson, and Jennifer Strong (2022) researched on the *Infant Developmental Outcomes: Influence of Prenatal Maternal–Foetal Attachment, Adult Attachment, Maternal Well-Being, and Perinatal Loss*. This study explores the influence of various prenatal maternal factors—maternal–fetal attachment, adult attachment, maternal well-being, and previous perinatal loss—on later infant development. The goal is to identify prenatal characteristics that could predict infant developmental outcomes, providing opportunities for early intervention to optimize childhood development.

2.5.1. Research Objectives and Design

The research aims to examine how prenatal maternal characteristics impact infant development as assessed both through maternal reports and external observations. Pregnant women completed self-report questionnaires on their prenatal experiences, and their infants were evaluated on development one to two years later using the Bayley Scales of Infant and Toddler Development (Bayley-III). Statistical analyses, including t-tests, correlational analyses, and multivariate linear regression, were employed to assess the relationships between these prenatal factors and later developmental outcomes.

2.5.2. Key Findings

- *Predictors of Infant Development*
 - **Maternal–Fetal Attachment:** Higher levels of maternal–fetal attachment were associated with more favorable maternal-reported adaptive behavior in infants. This supports previous research indicating that a strong emotional bond with the fetus positively influences perceptions of the infant’s development.
 - **Adult Attachment Patterns:** More secure and less anxious maternal adult attachment was linked to better maternal-reported adaptive behavior in infants. This suggests that a mother’s internal attachment patterns play a role in her perceptions of her infant’s development.
 - **Maternal Well-Being:** Better maternal well-being correlated with more favorable maternal-reported adaptive behavior. This aligns with existing literature on the impact of maternal mental health on infant development.
 - **Perinatal Loss:** Infants of women with a history of perinatal loss scored lower on cognitive development as rated by external observers, but this did not affect maternal reports of adaptive behavior.
- *Developmental Domains*
 - The study found no significant associations between maternal–fetal attachment, adult attachment, or maternal well-being with infant cognition, motor skills, language, or social-emotional development as assessed by Bayley-III. This indicates that while these factors influence adaptive behavior, they may not directly impact other specific developmental domains.

2.5.3. Methodological Strengths

- *Comprehensive Assessment:* The use of both maternal self-report and external observer-rated measures provides a well-rounded view of infant development, addressing the limitations of relying solely on maternal reports.
- *Focus on Prenatal Factors:* By examining multiple prenatal factors and their effects on a range of developmental outcomes, this study offers a nuanced understanding of how early maternal experiences can shape infant development.

2.5.4. Areas for Improvement

- *Sample Size and Power:* The relatively small sample size (40 dyads) limits the study's power and generalizability. Larger studies are needed to confirm these findings and enhance their applicability across different populations.
- *Drop-Out and Selection Bias:* The high drop-out rate between the two time points and potential selection bias due to voluntary participation may affect the representativeness of the sample. Future research should address these issues to improve the reliability and generalizability of results.
- *Measurement Limitations:* The external rater's knowledge of participants' perinatal loss status may have introduced bias into the developmental assessments. Blinding raters to such information could mitigate this risk in future studies.

2.5.5. Implications For Practice and Research

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2.5.6. Conclusion

This study provides valuable insights into the role of prenatal maternal characteristics in shaping later infant development. While it highlights the importance of maternal-fetal attachment, adult attachment, and maternal well-being in predicting adaptive behavior outcomes, it also underscores the need for further research to fully understand the impact on various developmental domains and to address methodological limitations. The results contribute to the broader understanding of how early maternal experiences influence infant development and highlight areas for potential intervention and support.

3. Conclusion

The context underscores the profound impact that maternal mental health and prenatal attachment have on both the mother and child's well-being. The review highlights the importance of understanding maternal-fetal attachment throughout pregnancy, emphasizing that this bond begins well before birth and can shape a child's developmental trajectory. While much research has traditionally focused on postpartum interactions, this review calls attention to the critical need for more comprehensive studies that examine attachment throughout the entire pregnancy. The review also identifies significant gaps in the current literature, particularly the need for longitudinal studies that track maternal attachment over time and across different populations. By addressing these gaps, future research can provide more detailed insights into how maternal behaviors, mental health, and environmental factors during pregnancy influence fetal and infant development. The study further stresses the importance of promoting maternal well-being to foster a supportive environment, ultimately benefiting both mother and child. Overall, this review makes a valuable contribution to the understanding of prenatal and postnatal bonding, offering actionable insights for interventions that could mitigate adverse outcomes associated with poor maternal-fetal attachment. It highlights the interconnectedness of prenatal and postnatal periods and suggests that enhancing prenatal attachment could serve as a protective factor for both the mother and child. Future research should focus on addressing the methodological limitations

and expanding the scope of study populations to ensure more generalizable and impactful findings, ultimately improving maternal and infant health outcomes.

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