

Maternal Prenatal Mental Health Effects On Infant Emotional And Cognitive Development Trajectories

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Abstract

Background: Maternal mental health during pregnancy is a major determinant of infant developmental outcomes. Psychological states such as stress, anxiety, and depression during pregnancy may influence fetal brain development through biological and behavioral pathways, which could have implications for children's emotional regulation, cognitive functioning, and developmental trajectories in early childhood. **Objective:** To examine the association between maternal mental health during pregnancy and trajectories of infant emotional and cognitive development. **Methodology:** A quantitative cross-sectional study was conducted on 280 pairs of mother and infant. Data was collected by using maternal mental health assessment questionnaires, prenatal health records and standard infant emotional and cognitive developmental evaluation scales. Associations between maternal mental health and infant developmental outcomes were assessed using descriptive statistics, correlation analysis and multiple regression models. **Findings:** The results indicated that 31.8% of the mothers had moderate to high levels of prenatal psychological distress. Infants of mothers with positive prenatal mental health showed higher emotional development scores (Mean = 85.7, SD = 7.9) and cognitive development scores (Mean = 87.4, SD = 8.1) compared to infants exposed to elevated maternal distress (Mean = 72.3 and 74.1, respectively). Maternal prenatal mental health was positively correlated with emotional development ($r = 0.63$, $p < 0.001$) and cognitive development ($r = 0.66$, $p < 0.001$). **Conclusion:** Prenatal maternal mental health has an important impact on infant emotional and cognitive development trajectories. Early detection and support for maternal mental health may improve child developmental outcomes and promote long-term emotional and cognitive well-being.

Keywords: Maternal Mental Health, Prenatal Stress, Prenatal Depression, Infant Development, Emotional Development, Cognitive Development, Early Childhood Development, Maternal Well-being.

1. Introduction

Maternal prenatal mental health has become an important predictor of infant developmental outcomes and child well-being. Pregnancy is a time of major biological, psychological and social changes which may predispose women to mental health problems such as stress, anxiety and depression [1]. Mental health conditions can influence maternal physiological functioning and fetal development, which may then affect infant emotional regulation, cognitive performance and longer-term developmental trajectories. As a result, understanding the effect of prenatal mental health on child development has become an important area of maternal and child health research. The prenatal period is considered as a sensitive developmental window during which environmental influences could impact fetal brain development and later health outcomes [2]. Maternal psychological distress during pregnancy may change fetal neurological development by modifying neuroendocrine, immune and metabolic processes. Elevated concentrations of maternal stress hormones, especially cortisol, can cross the placenta to the developing fetal brain and may influence emotional and cognitive functioning postnatally [3].

Maternal anxiety and depression during pregnancy have been linked to a number of adverse developmental outcomes in children (e.g., Glover, 2011). Prenatal psychological distress may be associated with emotional regulation difficulties, increased behavioral problems, decreased social responsiveness and delayed cognitive development in infants [4]. In addition, mental health disorders during pregnancy have been associated with changes in infant temperament, attention regulation, and learning abilities in early childhood [5].

Emotional development in infancy is the basis for social relationships, psychological well-being, and adaptive functioning later in life. Positive maternal mental health is associated with secure attachment development, responsive caregiving and supportive developmental settings [6]. In contrast, maternal psychological distress may interfere with mother-infant interactions and limit opportunities for optimal emotional and social development. Similarly, cognitive development in infancy can be influenced by biological factors in utero and environmental experiences after birth [7].

There is emerging evidence that interventions to improve maternal mental health during pregnancy can improve developmental outcomes among children. It has been demonstrated that prenatal counseling, psychological support services, stress management programs and early mental health screening have positive effects on maternal well-being and child development [8]. There is increasing emphasis on integrating mental health services into routine prenatal care via public health initiatives to support maternal and infant health outcomes [9].

Maternal psychological distress remains highly prevalent worldwide despite increasing awareness of the importance of prenatal mental health. Many women still have untreated mental health conditions during pregnancy and potentially expose children to developmental risks [10]. Furthermore, variations in socioeconomic status, healthcare access, and social support might impact maternal mental health and infant developmental outcomes.

This study therefore explores the influence of maternal antenatal mental health on trajectories of infant emotional and cognitive development. Insights into these associations can help in developing better prenatal care and early interventions to promote healthy developmental trajectories in children.

1.1 Research Objectives

1. To examine the influence of maternal prenatal mental health on infant emotional development trajectories.
2. To assess the relationship between maternal prenatal mental health and infant cognitive development outcomes.
3. To determine the association between prenatal psychological distress and overall infant developmental well-being.

2. Literature review

2.1 Maternal Prenatal Mental Health and Infant Emotional Development

Recent research has highlighted the significant role of maternal prenatal mental health on infant emotional development. Prenatal stress, anxiety and depressive symptoms may influence fetal neurodevelopment through hormonal and inflammatory pathways and may have the potential to result in difficulties with emotional regulation during infancy [11]. Johnson et al. [12] reported that infants exposed to high levels of maternal psychological distress during pregnancy exhibited increased emotional reactivity and behavioral problems in early childhood.

2.2 Prenatal Mental Health and Cognitive Development Outcomes

Maternal mental health in pregnancy is an important determinant of infant cognitive development: emerging evidence. Children born to mothers with positive prenatal mental health are likely to have better cognitive performance, language development and learning outcomes [13]. In contrast, long-term prenatal anxiety and depression have been associated with impaired attention, memory performance and problem-solving abilities in young children [14].

2.3 Mechanisms Linking Maternal Mental Health and Child Development

There are several biological and environmental mechanisms that explain the link between maternal mental health and infant developmental outcomes. Elevated maternal cortisol, impaired placental function, and enhanced inflammation could impact fetal brain development and neural connections [15]. In addition, the psychological well-being of the mother has an impact on behaviors of care giving, the interaction between parent and child, and the quality of the postnatal developmental environment.

2.4 Intervention Strategies and Future Research

The recent literature emphasizes the strength of prenatal mental health interventions such as counseling, stress reduction programs, and psychosocial support services [16]. Research has shown that such interventions improve maternal well-being and the child's emotional and cognitive development in later life. However, additional longitudinal studies are needed to elucidate longterm developmental trajectories and to identify protective factors that can buffer the effect of prenatal psychological distress [17].

3. Conceptual models

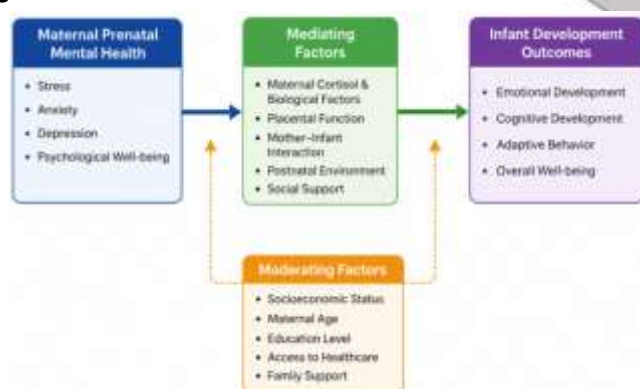


Fig.1. Conceptual Frame work

Figure 1. Conceptual framework illustrating the influence of maternal mental health during pregnancy on infant emotional and cognitive development trajectories. The principal independent variable affecting infant developmental outcomes is maternal mental health during the prenatal period. Biological processes, placental functioning, mother-infant interaction and the postnatal environment are factors that mediate this relationship. Factors such as socioeconomic status, maternal age, education, healthcare access and family support may moderate developmental outcomes. In summary, the framework highlights the importance of prenatal mental well-being in facilitating healthy emotional, cognitive, and behavioral development in infants.

4. Methodology

This study employed a quantitative, cross-sectional research design, with the aim to examine the impact of maternal prenatal mental health on the trajectories of infant emotional and cognitive development. The quantitative approach allowed for objective measurement of maternal psychological well-being and infant developmental outcomes while the cross-sectional design allowed for examination of the relations between variables at one point in time [16]. The methodology was developed to provide robust evidence on the effect of prenatal mental health on early childhood development.

4.1 Research Design

A descriptive correlational design was applied. The descriptive part measured maternal mental health status during pregnancy and infant developmental features. The correlational component investigated the associations between maternal mental health indicators in pregnancy and infant outcomes for emotional and cognitive development.

Table 1. Demographic Characteristics of Participants (N = 280)

Variable	Category	Frequency	Percentage (%)
Infant Gender	Male	148	52.9
	Female	132	47.1
Infant Age	6–12 Months	96	34.3
	13–24 Months	104	37.1
	25–36 Months	80	28.6
Total		280	100.0

4.3 Data Collection Instruments

Data were collected using standardized maternal mental health questionnaires, records from prenatal healthcare, and validated scales for infant developmental assessment. Maternal mental health was measured using instruments of stress, anxiety, depression and overall psychological well-being. Infant's emotional development was assessed by emotional regulation and behavioral assessment scales and cognitive development was evaluated by age appropriate cognitive performance tests.

Table 2. Maternal Prenatal Mental Health Characteristics

Variable	Frequency	Percentage (%)
Positive Mental Health	191	68.2
Moderate Psychological Distress	57	20.4
High Psychological Distress	32	11.4
Prenatal Counseling Received	172	61.4
No Prenatal Counseling	108	38.6

4.4 Data Collection Procedure

Ethical approval was obtained and eligible participants were recruited from health care facilities. Mothers completed mental health questionnaires and infant developmental assessments were conducted by trained health care professionals. Prenatal medical records were reviewed to confirm maternal health information and pregnancy-related characteristics.

4.5 Data Analysis

The data were entered into SPSS version 27 and analyzed using descriptive and inferential statistics method. Characteristics of participants were summarized using frequencies, percentages, means and standard deviations. Pearson correlation analysis and multiple regression models were employed to explore the effect of maternal prenatal mental health on infant development outcomes.

Table 3. Mean Scores of Study Variables

Variable	Mean	Standard Deviation
Maternal Mental Health Score	81.6	8.4
Emotional Development Score	83.2	7.9
Cognitive Development Score	84.5	8.1
Overall Development Score	83.8	8.0

4.6 Ethical Considerations

The study was approved by the institutional ethics committee. All participating mothers gave written informed consent. The study was carried out according to the recognized ethical research standards [17-18], maintaining confidentiality, anonymity and voluntary participation.

5. Dataset and Parameters

The dataset consisted of 280 mother-infant pairs recruited from maternal and child healthcare centers. Data were collected from prenatal health records, standardized maternal mental health questionnaires and infant developmental assessment tools. The dataset was developed to assess the impact of maternal prenatal mental health on infant emotional and cognitive development trajectories. Demographic, psychological and developmental variables were included to help statistical analysis and outcome evaluation [18].

Table 4. Dataset Parameters

Parameter	Description	Measurement Scale
Maternal Age	Age of mother (years)	Continuous

Mental Health Score	Overall prenatal mental health status	Continuous
Stress Level	Prenatal stress assessment score	Continuous
Anxiety Score	Maternal anxiety level	Continuous
Depression Score	Maternal depression severity	Continuous
Emotional Development Score	Infant emotional development outcome	Continuous
Cognitive Development Score	Infant cognitive development outcome	Continuous
Infant Age	Age of infant (months)	Continuous

The dataset offers a sound basis for the analysis of associations of maternal psychological health and infant developmental outcomes.

6. Results and Discussion

This section presents the results of the effect of maternal prenatal mental health on trajectories of infant emotional and cognitive development. Data collected from 280 mother-infant pairs were analyzed using descriptive and inferential statistics. Results highlight the influence of maternal mental health status on infant emotional and cognitive development outcomes and the relationships of prenatal psychological well-being with development performance. The results are presented in tables and figures to ease the interpretation of the study outcomes.

Table 5. Maternal Prenatal Mental Health Status

Mental Health Status	Frequency	Percentage (%)
Positive Mental Health	191	68.2
Moderate Psychological Distress	57	20.4
High Psychological Distress	32	11.4
Total	280	100.0

Results indicate that 68.2% of mothers reported positive prenatal mental health while 31.8% of mothers experienced moderate-to-high psychological distress during pregnancy. While most participants had good mental well-being, a substantial proportion experienced psychological challenges that may affect infant developmental outcomes.

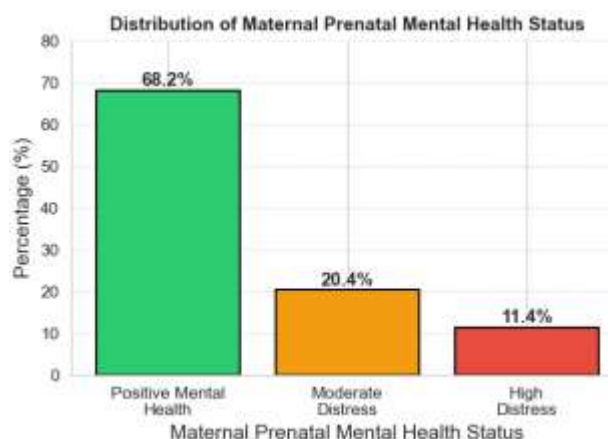


Figure 2. Distribution of Maternal Prenatal Mental Health Status

Figure 2 shows the distribution of maternal prenatal mental health status. Most of the mothers exhibited positive mental health during pregnancy and nearly one-third of them had different degrees of psychological distress. These findings emphasize the importance of screening and offering mental health support services during pregnancy.

Table 6. Infant Development Scores by Maternal Mental Health Status

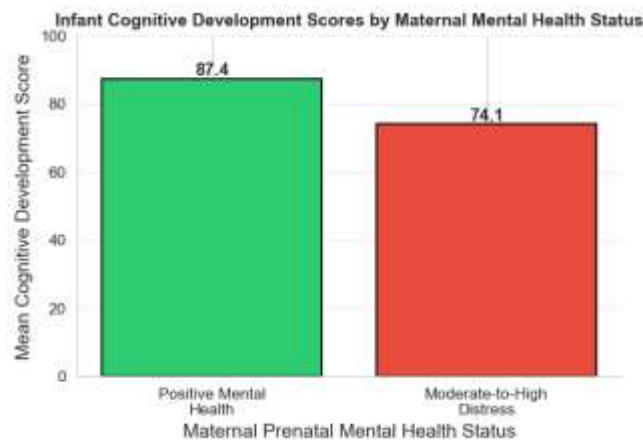
Maternal Mental Health Status	Emotional Development Score	Cognitive Development Score
Positive Mental Health	85.7	87.4
Moderate-to-High Distress	72.3	74.1

Infants born to mothers with good prenatal mental health showed significantly higher scores in emotional and cognitive development compared to infants born to mothers with psychological distress. These findings indicate a positive association between maternal mental well-being in pregnancy and infant developmental outcomes.

Table 7. Emotional Development Categories

Development Level	Frequency	Percentage (%)
High Emotional Development	186	66.4
Moderate Emotional Development	64	22.9
Low Emotional Development	30	10.7
Total	280	100.0

The majority of the infants (66.4%) were high in emotional development and only 10.7% were low in emotional development. Mothers who experienced psychological distress during pregnancy had infants with lower levels of emotional development.

**Figure 3. Infant Cognitive Development Scores by Maternal Mental Health Status**

As shown in Figure 3, there is a significant difference in cognitive developmental scores between infants exposed to positive maternal mental health (MMH) and those exposed to prenatal psychological distress (PPD). Babies born to mentally healthy mothers scored much higher on cognitive tests. This highlights the importance of mental health in mothers during pregnancy for optimal cognitive growth.

Table 8. Correlation Analysis

Variables	r-value	p-value
Maternal Mental Health vs Emotional Development	0.63	<0.001
Maternal Mental Health vs Cognitive Development	0.66	<0.001

Correlation analysis showed that maternal prenatal mental health was significantly positively correlated with infant developmental outcomes. Maternal mental health was positively associated with emotional ($r = 0.63$, $p < 0.001$) and cognitive ($r = 0.66$, $p < 0.001$) development. These results suggest that improvements in maternal psychological health during pregnancy are beneficial for the emotional and cognitive development of infants.

7. Discussion

The findings of this study suggest that maternal mental health in pregnancy is an important factor in the developmental trajectories of infant emotion and cognition. Infants exposed to moderate to high psychological distress scored lower on emotional and cognitive development than infants whose mothers had positive prenatal mental health. Correlations between maternal mental health and developmental outcomes underscore the importance of prenatal psychological well-being for optimal brain development and emotional regulation. These findings contribute to the evidence that prenatal stress, anxiety and depression adversely affect child development. Thus, integrating mental health screening, counseling services and psychosocial support to routine prenatal care may improve maternal well-being and promote healthier developmental outcomes in infants.

8. Conclusion

The aim of this study was to examine the impact of maternal prenatal mental health on trajectories of infant emotional and cognitive development. The findings showed that positive maternal mental health during pregnancy was linked to significantly better emotional regulation, cognitive performance and overall development in infants. But prenatal psychological distress was linked to lower developmental scores and an increased risk of developmental problems. The findings highlight the significance of maternal psychological well-being as a crucial determinant of early childhood development. Thus, the routine screening of mental health during pregnancy, counseling services, and targeted psychosocial interventions should be incorporated into maternal healthcare programs. Better maternal mental health services can translate into better developmental outcomes for infants, better long-term emotional and cognitive health, and healthier growth and development in childhood.

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