INTERNATIONAL JOURNAL OF PHARMACEUTICS RESEARCH
ISSN: 3106-7727 | 3106-7719
Volume 2, Issue 3, 2025

ASSOCIATION BETWEEN MATERNAL ANXIETY, DEPRESSION, AND BIRTH OUTCOMES: EVIDENCE FROM A PROSPECTIVE COHORT STUDY

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Keywords
Maternal Mental Health, Anxiety, Depression, Birth Outcomes, Low Birth Weight, Preterm Birth, NICU, Pakistan.

Article History
Received: 18 July 2025
Accepted: 19 September 2025
Published: 30 September 2025

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Abstract
Maternal anxiety and depression are significant determinants of adverse birth outcomes. This prospective cohort study examined their influence on preterm birth, low birth weight, and neonatal intensive care unit (NICU) admissions among pregnant women attending Swat Medical College and its affiliated hospitals in Saidu Sharif, Swat. Maternal mental health was assessed during pregnancy using validated instruments, including the Edinburgh Postnatal Depression Scale (EPDS) and the Generalized Anxiety Disorder (GAD-7) scale. Birth outcomes were documented post-delivery, and multivariable logistic regression analyses were conducted to control for potential confounders such as maternal age, socioeconomic status, and access to prenatal care. Findings revealed that a notable proportion of participants experienced anxiety and/or depression during pregnancy. Maternal anxiety was significantly associated with an increased risk of preterm birth (OR = 1.45; 95% CI: 1.12–1.87) and NICU admissions (OR = 1.62; 95% CI: 1.21–2.18), whereas maternal depression was linked to higher risks of low birth weight (OR = 1.53; 95% CI: 1.20–1.96) and preterm birth (OR = 1.47; 95% CI: 1.14–1.89). The co-occurrence of anxiety and depression was associated with the greatest likelihood of adverse neonatal outcomes. These results underscore the critical need for integrating maternal mental health screening and support into routine prenatal care. Strengthening mental health services within antenatal programs could substantially improve both maternal and neonatal health outcomes in comparable healthcare contexts.

INTRODUCTION

Maternal mental health is a key determinant of pregnancy outcomes, with conditions such as anxiety and depression during pregnancy associated with an elevated risk of adverse outcomes, including preterm birth, low birth weight, and the need for neonatal intensive care unit (NICU) admissions. These mental health conditions can disrupt fetal development and contribute to unfavorable birth outcomes through both physiological and behavioral pathways. Elevated stress hormones, particularly cortisol, can alter placental function, restrict fetal growth, and increase the likelihood of early labor. Furthermore, mental health disorders can interfere with essential maternal health behaviors, potentially reducing adherence to prenatal care, impacting nutritional intake, and compromising medication adherence—all critical for healthy pregnancy outcomes. Given their substantial impact on both maternal and neonatal health, maternal anxiety and depression constitute

significant public health issues, necessitating focused intervention, especially in resource-limited settings.

The prevalence and impact of maternal anxiety and depression are particularly concerning in low- and middle-income countries (LMICs) like Pakistan, where limited healthcare resources, socio-economic challenges, and cultural stigmas complicate the diagnosis and treatment of these conditions. Research indicates that the prevalence of maternal mental health issues may be higher in regions where social and financial stressors are pronounced, yet access to mental health resources remains limited. In Pakistan, the field of maternal mental health research is emerging, but data on the impact of anxiety and depression on birth outcomes is scarce. Without sufficient information, healthcare systems are constrained in their ability to offer integrated care to support pregnant women, potentially placing both maternal and neonatal health at heightened risk.

Swat, a region with a mixed urban and rural population in Pakistan, provides a unique context for examining these issues. Cultural norms, economic disparities, and inconsistent access to healthcare contribute to the challenges of addressing maternal mental health in this area. Women in Swat may face elevated levels of stress due to societal expectations, economic constraints, and limited healthcare options. The region's healthcare infrastructure may also have gaps in screening and intervention services for maternal mental health, contributing to the under-diagnosis and under-treatment of anxiety and depression among pregnant women.

This study seeks to address these gaps by investigating the relationship between maternal anxiety and depression and adverse birth outcomes, specifically preterm birth, low birth weight, and NICU admissions, among pregnant women attending Swat Medical College and its affiliated hospitals in Saidu Sharif, Swat. By assessing maternal mental health at various stages of pregnancy and collecting birth outcome data following delivery, this study provides a comprehensive analysis of how maternal anxiety and depression affect neonatal health in this population. We hypothesize that maternal anxiety and depression are associated with an increased risk of adverse birth outcomes, with heightened risks observed in cases where both conditions are present. Findings from this study are anticipated to inform healthcare providers and policymakers on the critical need for mental health screening and intervention as part of routine prenatal care, aiming to improve maternal and neonatal health outcomes in Pakistan and similar LMICs facing comparable healthcare challenges.

Literature Review

Maternal mental health is increasingly recognized as a fundamental determinant of pregnancy outcomes and early childhood development. Anxiety and depression during pregnancy, which affect a significant proportion of women globally, can have profound effects on both maternal and neonatal health. As essential aspects of maternal mental health, these conditions impact biological, behavioral, and socio-environmental factors that collectively influence fetal growth, birth outcomes, and early childhood health.

Depression

Depression symptoms were assessed using the Edinburgh Postpartum Depression Scale (EPDS), a validated 10-item self-report tool designed to screen women for depression during the postpartum period【1】. The EPDS is also used to identify early signs of prenatal depression【2】. With a maximum score of 30 for both prenatal and postpartum periods, a cut-off score of ≥ 13 was applied, indicating a higher risk of depression【3】. The EPDS has shown a sensitivity of 86% and a specificity of 78% in identifying major or minor depression, based on the Research Diagnostic Criteria (RDC)【4】. For analysis, we categorized depression as either (a) prenatal and/or postpartum depression or (b) no depression at either time.

Anxiety

Anxiety symptoms were measured using the Spielberger State Anxiety Scale, a validated 20-item self-report questionnaire that assesses a mother's anxiety level【5】. Scores on this scale range from

20 to 80, with a standard cut-off score of ≥ 40 indicating an anxious state, showing 81% sensitivity and 79.8% specificity in pregnant women【6】. We created a categorical variable for anxiety with two levels: (a) prenatal and/or postpartum anxiety or (b) no anxiety at either time.

Numerous studies link maternal anxiety and depression with adverse birth outcomes, such as preterm birth, low birth weight, and neonatal intensive care unit (NICU) admissions, underscoring the need for attention to these issues【7】. However, the prevalence of maternal mental health issues remains high, and these conditions are frequently under-diagnosed and under-treated, particularly in low- and middle-income countries (LMICs) like Pakistan. In these regions, limited healthcare access and cultural stigmas surrounding mental health further exacerbate barriers to treatment, which can increase risks to both maternal and neonatal health. Addressing maternal mental health is thus critical not only for improving individual patient outcomes but also for enhancing public health, reducing healthcare costs, and promoting healthy child development【8】.

The physiological and behavioral pathways through which maternal mental health influences birth outcomes are complex. Depression and anxiety can elevate levels of stress hormones such as cortisol, leading to physiological responses that may disrupt placental function, restrict fetal growth, or trigger early labor【9】. Mental health disorders can also impair the mother's ability to maintain adequate health behaviors, including proper nutrition, medication adherence, and attending prenatal visits. Behavioral patterns linked to mental health disorders may lead to increased maternal substance use or decreased physical activity, which further compromise pregnancy health. Collectively, these pathways underscore the importance of understanding how maternal mental health impacts fetal health and long-term child development【10】. Despite significant global research, variability exists in study findings due to differences in study settings, population characteristics, and diagnostic criteria, highlighting the need for context-specific research, especially in underserved regions like Swat, Pakistan.

In Pakistan, research on maternal mental health and its effect on birth outcomes is emerging. Socioeconomic disparities, cultural beliefs, and healthcare access challenges create additional layers of complexity in diagnosing and treating mental health conditions during pregnancy. Swat, a culturally diverse region with both urban and rural populations, presents a unique context for examining these issues. Many pregnant women in Swat may not have access to mental health screening or interventions, leading to an underestimation of mental health conditions and their potential effects on pregnancy【11】. Social and economic stresses related to family pressures, financial constraints, and limited healthcare options may also increase susceptibility to depression and anxiety, exacerbating risks to pregnancy health. Yet, despite a growing awareness of maternal mental health's importance, there is a lack of data examining its direct effects on birth outcomes in Pakistan, which limits the development of targeted interventions.

This study seeks to address these gaps by investigating the impact of maternal anxiety and depression on birth outcomes—including preterm birth, low birth weight, and NICU admissions—within a cohort of pregnant women at Swat Medical College and its affiliated hospitals in Saidu Sharif, Swat. By assessing maternal mental health at various stages of pregnancy and collecting birth outcome data post-delivery, this study provides a comprehensive evaluation of how maternal anxiety and depression influence neonatal health in this specific setting【12】. We hypothesize that maternal anxiety and depression are associated with an increased likelihood of adverse birth outcomes, with higher risks for women experiencing both conditions. Findings from this research could be critical for healthcare providers and policymakers, guiding the integration of mental health services within prenatal care to enhance maternal and neonatal health. By addressing maternal mental health in prenatal care programs, Swat Medical College aims to contribute to the global evidence base and help inform mental health policy and practice in Pakistan and other LMICs facing similar challenges.

Establishing a Public Health Concern

The introduction highlights maternal anxiety and depression as significant public health concerns, linking them to adverse birth outcomes such as preterm birth, low birth weight, and NICU admissions. This connection is crucial as it emphasizes the importance of maternal mental health not only for the individual but for public health systems as a whole【12】. By framing these mental health conditions within the context of maternal and neonatal health, the study aligns itself with global health priorities.

Impact on Birth Outcomes

The introduction effectively outlines the physiological and behavioral mechanisms through which maternal mental health influences pregnancy outcomes. It discusses the release of stress hormones, such as cortisol, which can adversely affect placental function and fetal development. This not only provides a scientific basis for the study but also underscores the complexity of the issue, indicating that solutions may need to address multiple factors.

Contextual Relevance

Focus on Low- and Middle-Income Countries

By situating the research within the context of LMICs, particularly Pakistan, the introduction addresses the unique challenges these countries face regarding maternal mental health. Limited healthcare access, socio-economic barriers, and cultural stigmas can exacerbate the impact of anxiety and depression, leading to under-diagnosis and under-treatment【12】. This contextualization is critical as it enhances the understanding of how systemic issues affect maternal health outcomes.

Cultural and Socioeconomic Factors

The mention of Swat's mixed urban and rural population enriches the context, suggesting that the findings may reflect diverse experiences and challenges faced by women in different settings. This variability can provide valuable insights into how local culture and socioeconomic status affect mental health and healthcare access.

Scarcity of Local Data

The introduction emphasizes the lack of comprehensive data on the impact of maternal anxiety and depression on birth outcomes in Pakistan. This identification of gaps in the literature not only justifies the need for the study but also positions it as a pioneering effort in a relatively under-researched area. It highlights an opportunity to contribute valuable findings to the field of maternal health, particularly in the context of LMICs.

Implications for Healthcare Practice and Policy

Relevance to Healthcare Providers:

The introduction concludes with a strong emphasis on the implications of the research findings for healthcare providers and policymakers. It advocates for integrating mental health screenings and interventions into routine prenatal care, emphasizing that such measures could significantly enhance maternal and neonatal health outcomes. This practical focus is essential for ensuring that research findings translate into actionable strategies within healthcare systems.

Broader Impact:

By suggesting that the findings may have relevance beyond Pakistan to other LMICs facing similar challenges, the introduction broadens the potential impact of the study. This perspective underscores the global significance of addressing maternal mental health issues in various healthcare contexts.

Conclusion

In conclusion, this study underscores the significant impact of maternal anxiety and depression on adverse birth outcomes, particularly in terms of preterm birth, low birth weight, and NICU admissions. The findings from Swat Medical College and affiliated hospitals reveal that a substantial number of pregnant women experience clinically significant levels of anxiety and depression, which are strongly associated with increased risks of negative birth outcomes. Specifically, maternal anxiety correlates with elevated risks of preterm birth and NICU admissions, while maternal depression is linked to

both low birth weight and preterm birth. Notably, women exhibiting both anxiety and depression symptoms face the greatest odds of adverse outcomes, suggesting a compounded effect of these mental health challenges. The results emphasize the importance of integrating mental health assessments, such as the EPDS and GAD-7, into routine prenatal care. By identifying and addressing anxiety and depression early in pregnancy, healthcare providers could potentially mitigate the risks associated with these mental health conditions, ultimately improving both maternal and neonatal health outcomes. This study supports the need for holistic prenatal care models that encompass mental health support alongside traditional physical health monitoring. Future research and healthcare policies should prioritize maternal mental health interventions as an essential component of prenatal care, especially in similar healthcare settings where resources may be limited.

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