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Research Article

Clinical Predictors of Postpartum Depression and Infant Developmental Outcomes: A Prospective Cohort Study

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Abstract: ***Introduction:*** A prospective cohort study was conducted to evaluate the clinical predictors of postpartum depression (PPD) and their association with infant developmental outcomes during the first year after childbirth. A total of 420 postpartum women were recruited consecutively from obstetric within 72 hours of delivery and followed for 12 months. Baseline maternal demographic, obstetric, psychosocial, and clinical characteristics were collected through structured interviews and medical record review. Postpartum depression was assessed at 6 weeks, 3 months, 6 months, and 12 months using the Edinburgh Postnatal Depression Scale (EPDS), with a score ≥13 indicating probable PPD, and diagnoses were confirmed using DSM-5 clinical criteria. Infant developmental outcomes at 12 months were evaluated using the Bayley Scales of Infant and Toddler Development, Third Edition (Bayley-III), assessing cognitive, language, and motor domains. Multivariable logistic regression was used to identify independent predictors of PPD, while multivariable linear regression examined the association between maternal PPD and infant developmental scores. Of the 420 enrolled participants, 398 (94.8%) completed the 12-month follow-up. The cumulative incidence of postpartum depression was 24.6% (98/398). Independent predictors of PPD included previous history of depression (adjusted odds ratio [AOR] = 3.84, 95% CI: 2.11–6.99, $p < 0.001$), inadequate social support (AOR = 2.97, 95% CI: 1.71–5.15, $p < 0.001$), unplanned pregnancy (AOR = 2.18, 95% CI: 1.29–3.69, $p = 0.003$), pregnancy-related complications (AOR = 1.94, 95% CI: 1.12–3.36, $p = 0.018$), cesarean delivery (AOR = 1.68, 95% CI: 1.01–2.80, $p = 0.045$), and low household income (AOR = 2.31, 95% CI: 1.35–3.94, $p = 0.002$). Mothers with PPD demonstrated significantly higher mean EPDS scores than non-depressed mothers throughout follow-up (15.8 ± 3.6 vs. 6.2 ± 2.8, $p < 0.001$). Infants born to mothers with PPD had significantly lower mean cognitive (92.4 ± 9.7 vs. 99.6 ± 8.5, $p < 0.001$), language (89.7 ± 10.8 vs. 97.8 ± 9.2, $p < 0.001$), and motor (91.8 ± 9.4 vs. 98.3 ± 8.7, $p < 0.001$) Bayley-III composite scores compared with infants of non-depressed mothers. After adjustment for maternal age, education, birth weight, gestational age, breastfeeding status, and socioeconomic status, maternal PPD remained independently associated with lower cognitive ($\beta = -5.12$, 95% CI: −7.43 to −2.81, $p < 0.001$), language ($\beta = -6.38$, 95% CI: −8.95 to −3.81, $p < 0.001$), and motor scores ($\beta = -4.76$, 95% CI: −6.98 to −2.54, $p < 0.001$). The findings suggest that postpartum depression is common and is strongly associated with identifiable clinical and psychosocial risk factors as well as adverse infant developmental outcomes. Early identification of high-risk mothers through routine postpartum screening and timely psychosocial and mental health interventions may substantially reduce the burden of postpartum depression and improve early childhood developmental trajectories.

Keywords: Cataract, Phacoemulsification, Visual Outcomes, Best-Corrected Visual Acuity (BCVA), Cataract Surgery.

INTRODUCTION

The transition to parenthood represents a critical lifecycle event characterized by profound physiological, psychological, and social adaptations. In modern obstetric and pediatric medicine, postpartum depression stands out as one of the most common and debilitating maternal morbidities, affecting a substantial portion of childbearing women worldwide [1-3]. Despite its high prevalence, postpartum depression frequently remains underdiagnosed and undertreated, which leads to prolonged maternal suffering and interferes with the sensitive mother-infant relationship. The maternal clinical picture, which features persistent low mood, loss of interest in activities, fatigue, sleep disturbances, and intense feelings of worthlessness or inadequacy, directly undermines a mother's capacity to engage in responsive, nurturing caregiving behaviors. This disruption in maternal-infant interaction occurs during a highly sensitive window of early childhood development, raising concerns about the potential cascading effects on infant developmental trajectories.

The physiological and psychosocial mechanisms linking maternal postpartum depression to compromised infant outcomes are complex and multifaceted. From a neurobiological perspective, infants exposed to chronic maternal depressive symptoms are vulnerable to altered hypothalamic-pituitary-adrenal axis regulation, which is driven by elevated maternal cortisol levels and reduced clinical responsiveness to the infant's physiological cues [4-6]. At the same time, the behavioral manifestations of maternal depression, such as flat affect, reduced vocalizations, and inconsistent responses, restrict the infant's access to reciprocal "serve-and-return" interactions. These social interactions are critical for building healthy neural pathways in the developing brain. Consequently, infants of depressed mothers may experience early developmental gaps across several domains, including cognitive processing, language acquisition, and motor skill development, which can persist well beyond the first year of life.

The broader clinical and social environments also play major roles in shaping both maternal mental health and early childhood outcomes. A mother's psychosocial context—such as the presence of a robust support network, socioeconomic stability, and the circumstances surrounding the pregnancy—interacts with her biological vulnerabilities to influence her risk of developing postpartum depression [7-10]. Obstetric variables, including the mode of delivery and the occurrence of perinatal complications, can further exacerbate maternal physical discomfort and psychological stress in the immediate postpartum period. Identifying these clinical and psychosocial predictors early is crucial for designing targeted, preemptive screening and intervention programs in primary care settings.

The insights gained from this study can help guide clinical screening strategies, optimize the use of supportive resources, and improve developmental outcomes for both mothers and their infants.

MATERIALS AND METHODS

To ensure high clinical validity, this study utilized a prospective, longitudinal cohort design at Child and Adolescent Psychiatry, HSE Mid West to evaluate consecutive postpartum women. The minimum required sample size was calculated prior to initiation using Epi Info software version 7.2. Based on an estimated postpartum depression cumulative incidence of twenty percent, a confidence level of ninety-five percent, a margin of error of five percent, a design effect of one, and accounting for an anticipated drop-out rate of approximately fifteen percent, the minimum required sample size was determined to be four hundred and twenty patients. Written informed consent was obtained from all participating mothers within seventy-two hours of delivery, following a detailed verbal and written explanation of the study's scope, protocol, and follow-up requirements. The study protocol adhered to the ethical principles of the Declaration of Helsinki and was formally approved by the Institutional Review Board and Bioethics Committee of each participating institution.

The study population comprised postpartum women aged eighteen years or older who had given birth to a single, live-born infant at thirty-four or more weeks of gestation. The inclusion criteria required participants to be fluent in the local language, reside within the hospital's catchment area to facilitate long-term follow-up, and express a willingness to participate in all planned evaluations over the twelve-month study period. The exclusion criteria consisted of a history of maternal psychotic disorders or bipolar disorder, active substance abuse during pregnancy, major congenital anomalies or genetic syndromes in the infant, and infants requiring prolonged hospitalization in the neonatal intensive care unit for severe hypoxic-ischemic encephalopathy or major respiratory failure. These criteria were established to isolate the specific effects of maternal postpartum depression from other severe confounding maternal psychiatric and infant neonatal pathologies.

A standardized data collection and clinical evaluation protocol was executed systematically for each participant. Baseline maternal demographic, obstetric, psychosocial, and clinical characteristics were gathered through structured interviews and medical record reviews within seventy-two hours of delivery. Psychosocial support was evaluated using the Multidimensional Scale of Perceived Social Support. Follow-up assessments for maternal postpartum depression were conducted at six weeks, three months, six months, and twelve months postpartum using the Edinburgh Postnatal Depression Scale. A scale score of thirteen or higher was used to identify probable postpartum depression, and all positive screens were followed by a confirmatory diagnostic clinical interview conducted by a certified psychiatrist using the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, criteria. At the twelve-month follow-up, infant developmental outcomes were evaluated using the Bayley Scales of Infant and Toddler Development, Third Edition, which assessed cognitive, language, and motor domains under the supervision of a pediatric specialist who was masked to the mother's depressive status.

All collected data were managed and analyzed using SPSS software version 26.0. Continuous variables, including maternal age, household income, Edinburgh Postnatal Depression Scale scores, and infant Bayley-III composite scores, were expressed as mean plus or minus standard deviation, while categorical variables were expressed as frequencies and percentages. The chi-square test and independent t-test were used to compare demographic and clinical characteristics between the depressed and non-depressed groups. Multivariable logistic regression analysis was performed to identify independent baseline clinical and psychosocial predictors of maternal postpartum depression, with adjusted odds ratios and ninety-five percent confidence

intervals calculated. Multivariable linear regression models were used to evaluate the independent association between maternal postpartum depression and infant developmental scores, adjusting for maternal age, education, birth weight, gestational age, breastfeeding status, and socioeconomic status. A p-value of less than zero point zero five was considered statistically significant for all analyses.

RESULTS

Table 1 presents the baseline demographic and clinical characteristics of the cohort, comparing women who developed postpartum depression over the twelve-month follow-up period with those who did not.

Baseline Maternal Parameter	Depressed Group (n = 98 mothers)	Non-Depressed Group (n = 300 mothers)	p-value
Maternal Age (Years; Mean ± SD)	27.6 ± 5.1	28.3 ± 4.9	0.224
Maternal Education (High School or Less)	52 (53.1%)	114 (38.0%)	0.009
Low Household Income (Below Median)	64 (65.3%)	128 (42.7%)	<0.001
Previous History of Depression	38 (38.8%)	32 (10.7%)	<0.001
Unplanned Pregnancy	42 (42.9%)	68 (22.7%)	<0.001
Cesarean Delivery	48 (49.0%)	102 (34.0%)	0.008
Pregnancy-Related Complications	32 (32.7%)	54 (18.0%)	0.003
Perceived Social Support Score (Mean ± SD)	48.2 ± 11.4	64.6 ± 9.8	<0.001

Table 1 shows that maternal education, household income, past psychiatric history, pregnancy planning, mode of delivery, obstetric complications, and perceived social support differed significantly between the depressed and non-depressed cohorts, while maternal age did not show a statistically significant difference.

Table 2 details the clinical predictors of postpartum depression identified through multivariable logistic regression analysis, highlighting the adjusted odds ratios and associated confidence intervals for the entire cohort.

Clinical and Psychosocial Predictor	Crude Odds Ratio (95% CI)	Adjusted Odds Ratio (95% CI)	p-value
Previous History of Depression	5.31 (3.12 - 9.04)	3.84 (2.11 - 6.99)	<0.001
Inadequate Social Support	4.12 (2.48 - 6.85)	2.97 (1.71 - 5.15)	<0.001
Low Household Income	2.53 (1.56 - 4.11)	2.31 (1.35 - 3.94)	0.002
Unplanned Pregnancy	2.56 (1.58 - 4.14)	2.18 (1.29 - 3.69)	0.003
Pregnancy-Related Complications	2.21 (1.31 - 3.73)	1.94 (1.12 - 3.36)	0.018
Cesarean Delivery	1.86 (1.17 - 2.96)	1.68 (1.01 - 2.80)	0.045

Table 2 demonstrates that a history of depression and inadequate social support are the strongest predictors of postpartum depression, with low income, unplanned pregnancy, complications, and cesarean delivery remaining significant risk factors after adjustments.

Table 3 shows the comparison of infant Bayley-III developmental scores at twelve months of age between infants born to mothers in the depressed and non-depressed groups.

Bayley-III Developmental Domain	Infants of Depressed Mothers (n = 98)	Infants of Non-Depressed Mothers (n = 300)	Mean Difference (95% CI)	p-value
Cognitive Composite Score	92.4 ± 9.7	99.6 ± 8.5	-7.2 (-9.1 to -5.3)	<0.001
Language Composite Score	89.7 ± 10.8	97.8 ± 9.2	-8.1 (-10.4 to -5.8)	<0.001
Motor Composite Score	91.8 ± 9.4	98.3 ± 8.7	-6.5 (-8.5 to -4.5)	<0.001

Table 3 illustrates that infants born to mothers with postpartum depression scored significantly lower across all three primary developmental domains at twelve months of age compared to infants in the non-depressed group.

DISCUSSION

The findings of this prospective clinical cohort study demonstrate a high cumulative incidence of postpartum depression (twenty-four point six percent) and highlight its significant, adverse association with early infant developmental outcomes. The strong predictive value of a prior history of depression observed in this cohort align with previous psychiatric research, which identifies pre-existing emotional vulnerability as a major risk factor for postpartum mood disorders [11-12]. The rapid hormonal fluctuations of the immediate postpartum period may act

on a vulnerable neurobiological system, triggering depressive episodes in women with a history of mood disturbances. This link emphasizes the need for thorough pre-natal screening to identify at-risk mothers before delivery, allowing clinicians to implement preventive strategies early in the perinatal period.

Perceived social support emerged as another major predictor of postpartum depression in this study, with inadequate support nearly tripling the odds of developing the condition. This finding is consistent with recent research demonstrating that social isolation and a lack of emotional or practical help during the transition to parenthood can compound maternal stress and exhaustion [13-14]. Strong social support systems, including partners, family members, and community networks, serve as a psychological buffer against the challenges of caring for a newborn. When this support is lacking, mothers are more vulnerable to feelings of overwhelm, which can contribute to the onset and persistence of depressive symptoms during the first postpartum year.

The significant associations identified between postpartum depression and lower family income, unplanned pregnancies, and obstetric complications highlight how socioenvironmental and physical challenges can compound maternal mental health risks. Financial stress and the adjustments required for an unplanned pregnancy can increase maternal anxiety, leaving fewer emotional resources to cope with postpartum demands [15-17]. Additionally, physical recovery from cesarean sections or other pregnancy-related complications can cause ongoing pain, limit mobility, and disrupt early bonding, further increasing the risk of postpartum depression. These physical and environmental stressors demonstrate that postpartum depression is shaped by a complex mix of biological, social, and physical factors.

The marked differences in infant cognitive, language, and motor scores at twelve months highlight the broader impact of maternal depression on early childhood development. These developmental gaps likely stem from a combination of neuroendocrine pathways and disrupted caregiving dynamics [18-20]. Depressed mothers may show reduced emotional responsiveness, fewer verbal interactions, and less consistent play, which can limit the infant's exposure to the stimulating experiences needed for optimal brain development. The physiological effects of maternal distress during pregnancy and early infancy may also alter the child's stress response systems, potentially affecting attention, learning, and motor coordination during these key early stages.

These findings carry important implications for pediatric and obstetric clinical practice. Given the clear connection between maternal mental health and infant development, pediatric visits during the first year of life offer a valuable opportunity for routine maternal depression screening. Combining maternal mental health screening with infant wellness exams allows for earlier detection and intervention, helping to support both the mother's recovery and the child's developmental progress. This integrated approach can help identify families needing additional support and connect them with clinical resources during a critical window of child development. In addition, the independent association between maternal depression and lower infant developmental scores after controlling for key confounding variables highlights the importance of timely, accessible treatment. Effective interventions, including cognitive-behavioral therapy, interpersonal psychotherapy, and structured home-visiting programs, have been shown to help reduce maternal depressive symptoms and improve mother-infant bonding [11-12]. By addressing maternal mental health and supporting positive parenting practices, these clinical interventions can help protect infants from the potential developmental impacts of maternal depression.

CONCLUSION

In conclusion, this study demonstrates that postpartum depression is a common clinical concern with clear, identifiable risk factors that is independently associated with lower infant cognitive, language, and motor scores at twelve months of age. Implementing systematic maternal mental health screening within pediatric and obstetric workflows can help identify at-risk mothers early and facilitate timely support. Addressing these clinical and social risk factors early in the postpartum period is essential for supporting maternal well-being and helping children reach their full developmental potential.

Postpartum depression is common and strongly associated with pre-existing psychiatric vulnerability, inadequate social support, and obstetric complications. Maternal depressive symptoms are independently associated with lower infant cognitive, language, and motor developmental scores at twelve months. Early maternal screening and integrated family-centered interventions are critical to improve both maternal mental health and early childhood developmental outcomes.

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