ORIGINAL ARTICLE

# Risk factors for postnatal depression among recently delivered young women in Rural Karnataka, South India

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## ABSTRACT

Postnatal depression (PND) is a global public health issue that is associated with devastating and persistent outcomes in mothers and children. In India, PND affects one-in-five first-time mothers. Research on PND among populations in rural settings in India is limited. We aim to describe the prevalence of and risk factors for postnatal depression among a sample of women in their postnatal period in a rural setting in Mysore, South India. Participants were recruited from a large quasi-experimental study that examined the feasibility and acceptability of using mobile medical clinics for antenatal care and HIV testing for pregnant women living in rural communities. All postpartum women completed the PHQ-9 along with a brief survey after completion of the informed consent process. Logistic regression was used to identify factors associated with PND. A total of 148 mothers 16-20 weeks postpartum completed the study ($M_{age}$ = 22.9 years, SD ±3.40). About 18.9% met the screening cut-off for postnatal depression using PHQ-9 with scores ≥10. After controlling for age and interaction term for participants' age and their spouses' education level, postnatal mothers residing with husbands with higher levels of education had significantly lower odds of depression symptoms (Odds Ratio: 0.25; 95% CI: 0.10-0.6) as compared to those whose husbands had lower education levels. High prevalence of PND indicates the need for early screening, evidence-based intervention programs, and capacity building for frontline health workers such as Auxiliary Nurse Midwives and Accredited Social Health Activists who work closely with pregnant and postnatal mothers in rural communities. This study also indicates the need for research on husbands' level of understanding of PND, and their attitudes immediately after their wives' delivery in rural communities.

**Key words:**
global mental health, Rural South India, young women, postnatal depression

## INTRODUCTION

Postnatal depression (PND) is a significant public health problem leading to poor maternal and child health outcomes.[1,2,3] PND usually begins within four weeks of childbirth and may continue for several months or even up to a year.[4] Globally, the prevalence of PND ranges from 10 to 42%, with higher income countries reporting 13% to 19%.[5,6,7,8] and prevalence in South Asia ranging from 18-30% in urban areas, and 28%-36% in rural areas.[6,9,10,11] In India, PND affects one in every five first time mothers[12] highlighting it has significant public health concerns. The variation in the prevalence of PND globally and in South Asia can be attributed to the differences in the diagnostic criteria, the use of various screening tools, study methodologies and cultural perception of mental health.[1,9,20,42,44]

PND has devastating effects on the health and wellbeing of the mother, infant and family.[2,3,13,40] It is associated with negative mother-infant relationship/interaction[6], infant undernutrition[14], and poor developmental outcomes of infants.[3,15,16] Difficult temperament, poor self-regulation and behavioral problems have been observed in infants of mothers diagnosed with depression.[15] Several studies have shown maternal depression to be associated with internalizing and externalizing behavioral problems in infancy, which could lead to persistent impairment throughout child development and into adulthood.[16] Available evidence suggests that PND has a multifactorial etiology comprising demographic, socioeconomic, psychosocial, obstetric and medical risk factors.[18,19,20,45] Birth of a female child, low socioeconomic status, marital violence, lack of social support, previous psychiatric problems, and life events in the previous year were some of the unique factors associated with PND in countries like India, Pakistan and Turkey.[1,11,21,22] However, research on depression among postnatal mothers in rural India is limited.[9] Although some researchers have explored PND and its risk factors in India, only a few studies have been conducted among rural populations.[12] Studies published to date on the epidemiology of PND in South India have largely been hospital-based;[11,20,23] with only one study among the rural population in Bangalore available.[9] The prevalence and factors associated with PND in rural Mysore, Karnataka is not known. Hence, conducting research on PND among postnatal mothers in rural Mysore, Karnataka addresses this gap and provides essential data. It emphasizes specific risk factors, the need for community-based preventive measures that leverage local resources, training for healthcare providers, and the development of targeted interventions to mitigate PND, especially in rural settings. So, this study attempts to report the prevalence of postnatal depression and its correlates in a rural community setting in rural Karnataka, Southern India.

## METHODS

### *Objective*

The study aims to investigate the prevalence of postnatal depression and its risk factors among recently delivered young women between 16 to 20 weeks of the postpartum period in a rural community.

### *Study design & Study Population*

The present study adopts a cross-sectional research design and employs a survey approach to gather data from participants in a large quasi-experimental study that examined the feasibility and acceptability of using mobile medical clinics with social support to increase integrated antenatal care and HIV testing for women living in rural communities in India.[24] Mysore district is located in the southern region of Karnataka state and

spreads across seven sub-districts (taluks) namely *Mysore, Nanjangud, Tirumakudala Narasipura, Krishnarajanagar, Hunsur, Heggadadevankote* and *Periyapatna*. According to the census (2011), the district had a total population of 2,994,744 with 58.6% living in rural areas.[25] Around half of the population (49.3%) is female. Majority of the residents (97.6%) reported their religion as Hinduism. Estimated annual income per capita for rural residents was 16,086 Indian rupees [USD=$251.31] and 63.3% were literate, which was significantly lower than national statistics (38,005 Indian rupees [USD=581.52]; 74% literacy rate).[27,28,29]

The Public Health Research Institute of India (PHRII) provides antenatal care and HIV testing services to pregnant women residing in rural villages of Mysore District through a mobile medical care approach. The research staff invited participants who had previously received antenatal care from the PHRII mobile medical program and were within 20 weeks since delivery to participate in this study. After learning the purpose of the study, women who expressed interest were screened for eligibility. Eligibility criteria included 1) mothers who were between 16-20 weeks of postnatal period; 2) not having any major medical and surgical illness before and after delivery; 3) registered with the PHRII mobile medical program; and 4) ability to undergo informed consent process. Participants who were unable to undergo the informed consent process and mothers with twins or infants born preterm or having any major medical/surgical illness were not included in the study since it may increase the chances of depression. A total of 150 postnatal mothers were recruited for the study.

### Measures and Procedures

A pre-tested standardized questionnaire in the regional language of *Kannada* was used to collect information on demographics, psychosocial risk factors for postpartum depression, obstetric history, infant characteristics and details of the most recent delivery. Each participant also completed the revised Pareek and Trivedi socioeconomic status scale, which is a standardized measure for rural populations in India. Gururaj and colleagues revised the original Pareek and Trivedi socioeconomic status scale[29] and reported high reliability, $r = 0.93$.[30] The revised scale consisted of nine items, which gathered information about education, occupation, income, caste, land, house, social participation, farm power, material possessions and family type. Total score on this revised scale ranges from 13 to 43.[30] Based on the total scores, study participants were classified as belonging to the upper class (above 43), upper middle class 33-42), middle class (24-32), lower middle class (13-23) and lower class (below 13) as per norms provided by the authors.[29,30]

Postnatal depression was screened using the Patient Health Questionnaire (PHQ-9), which consists of nine items assessing depressive symptoms on a four-point scale (not at all, several days, more than half the days and nearly every day of the previous two weeks).[31] This brief screening tool is widely used for screening depression and takes less than 10 minutes to complete. This tool has been validated in several languages in India including Kannada and reported high reliability, r= 0.75.[36] The total score of PHQ-9 ranges from 0 to 27 with a score of ≥10 considered as having depression with 88% sensitivity and 88% specificity.[31,32] This cut-off is commonly used for screening major depression in primary care, and other clinical settings such as obstetrical and maternity clinics.[31,33]

*Ethical approval*

The study was approved by the Institutional Review Boards at Mysore, Karnataka, India (IRB Approval #2016-20-08-32) and Miami, Florida, USA (IRB-17-0067-AM01). Only participants who agreed to undergo the informed consent process were included in the study.

*Data analysis*

All analyses were conducted using R open source statistical software.[34] The prevalence of depression among postnatal mothers was calculated as the proportion of women who scored ≥10 on the PHQ-9 questionnaire. This cutoff score is commonly used in clinical settings to indicate the presence of depressive symptoms. Descriptive statistics including frequencies and proportions for categorical variables, and means and standard deviations for continuous variables were calculated to describe the study participants' characteristics and to inform subsequent inferential analysis. We examined the between-group differences (screened positive for PND vs. screened negative for PND) among mothers across categorical variables by using Fisher's exact tests to compute p-values (due to small sample sizes and unequal distribution). For normally distributed variables, the between-group differences for continuous outcomes were examined using *t*-tests. Variables that were statistically significant at trend level ($p < 0.10$) with PND were included in the logistic regression models. This inclusion criterion was established to ensure that potentially relevant variables were not omitted prematurely and to explore trends that may be significant in a larger sample. In terms of assumption testing of the logistic models, we examined linearity using scatter plots, influential values using Cook's distance, and multicollinearity using variance inflation factor (VIF). We report odds ratios (OR) with associated 95% confidence intervals (95%CI) along with other model parameters.

## RESULTS

Complete data were available for N=148 postnatal mothers. Two participants decided not to participate in the interview after providing informed consent because their husbands did not allow them to complete the study. The sociodemographic information of the sample is available in Table 1. The mean age of the women was 22.9 years (SD= 3.40). A vast majority of the women were Hindu (n=137; 92.6%), and nearly half of them belonged to backward castes (n=85; 57.4%) or scheduled castes/scheduled tribes (n=63; 42.6%). Only 6% (n=9) reported being illiterate (who could not read and write), and 92.6% (n=137) reported living in a joint family with other family members. All participants lived with their spouses, and 87.8% (n=139) of the spouses were literate. Among the spouses, 42.5% (n=68) were farmers by occupation, while the rest (n=80; 57.5%) were daily wage workers, salaried employees, or running their own businesses. According to the revised Uday Pareek and Trivedi socioeconomic status scale, 52% (n=77) of the participants were classified as lower class, and 48% (n=71) were classified as lower middle-class.

**Table 1.** The sociodemographic characteristics and depression among postnatal women in Mysore, India (N=148)

| Variables | Total | PHQ <10 (n = 120) | | PHQ ≥10 (n = 28) | | p-value |
|---|---|---|---|---|---|---|
| | M or N | M or n | SD or % | M or n | SD or % | |
| Age of participants (in years) | 22.8 | 22.6 | ±3.35 | 23.9 | ±3.46 | 0.08 |
| Education status (participant)* | | | | | | |
|   Illiterate | 6 | 5 | 4% | 1 | 4% | 0.44 |
|   Primary School | 6 | 6 | 5% | 0 | 0% | |
|   Middle School | 30 | 21 | 18% | 9 | 32% | |
|   High School | 93 | 77 | 64% | 16 | 57% | |
|   Graduate and above | 13 | 11 | 9% | 2 | 7% | |
| Education status (husband) | | | | | | |
|   Illiterate | 9 | 8 | 7% | 1 | 4% | 0.01 |
|   Primary School | 8 | 5 | 4% | 3 | 11% | |
|   Middle School | 28 | 17 | 14% | 11 | 39% | |
|   High School | 74 | 63 | 53% | 11 | 39% | |
|   Graduate and above | 29 | 27 | 23% | 2 | 7% | |
| Occupation (Husband) | | | | | | |
|   Daily wage laborer | 41 | 32 | 27% | 9 | 32% | 0.90 |
|   Agriculturist | 69 | 56 | 47% | 13 | 46% | |
|   Business | 27 | 22 | 18% | 5 | 18% | |
|   White-collar worker | 11 | 10 | 8% | 1 | 4% | |
| Religion | | | | | | |
|   Hindu | 137 | 110 | 92% | 27 | 96% | 0.69 |
|   Non-Hindu | 11 | 10 | 8% | 1 | 4% | |
| Caste | | | | | | |
|   SC/ST | 63 | 51 | 42% | 12 | 43% | 1.00 |
|   OBC | 85 | 69 | 58% | 16 | 57% | |
| Family type | | | | | | |
|   Nuclear | 11 | 10 | 8% | 1 | 4% | 0.69 |
|   Joint | 137 | 110 | 92% | 27 | 96% | |
| Socio-economic Status of the family | | | | | | |
|   Lower class | 77 | 61 | 51% | 16 | 57% | 0.68 |
|   Lower middle class | 71 | 59 | 49% | 12 | 43% | |

Note. All *p* values associated with chi-square tests are reported from Fisher's exact tests.
SC/ST = schedule caste/schedule tribe. OBC = other backward castes.
*Education: Primary school indicates schooling up to class 4, middle school indicates classes 5 to 8 and high school classes 9 to 12.

The obstetric characteristics of the postnatal women are described in Table 2. One in two of the participants (n=86; 58.1%) were *primigravidas,* and 82.4% (n=124) of the participants reported having visited a Primary Health Centre (PHC) for additional antenatal care check-ups. While 73.7% (n=109) of the pregnant women had delivered their infants at a government hospital, 26.3% (n=39) delivered at a private hospital. Only 14.2% (n=21) of the participants had a past history of abortion/miscarriages. Most of the participants (n=110; 74.3%) had a normal vaginal delivery, with 47.3% (n=70) women having delivered male babies, and 7% (n=13) reporting having low birth weight infants (less than 2500 gms).

**Table 2.** Reproductive Health Characteristics of the postpartum women in rural Mysore, India

| Variables | Total | PHQ9 <10 | | PHQ9 ≥10 | | |
|---|---|---|---|---|---|---|
| | *N* | *n* | *%* | *n* | *%* | *p-value* |
| Mode of delivery | | | | | | |
|   Normal vaginal | 110 | 89 | 74% | 21 | 75% | 1.00 |
|   Cesarean section | 38 | 31 | 26% | 7 | 25% | |
| Birth weight of the infant* | | | | | | |
|   Normal | 135 | 110 | 92% | 25 | 89% | 0.71 |
|   Low birth weight | 13 | 10 | 8% | 3 | 11% | |
| ANC follow-up visits | | | | | | |
|   ≤5 visits | 24 | 17 | 14% | 7 | 25% | 0.17 |
|   >5 visits | 124 | 103 | 86% | 21 | 75% | |
| Gravidity | | | | | | |
|   Primigravida | 86 | 70 | 58% | 16 | 57% | 0.91 |
|   Multigravida | 62 | 50 | 42% | 12 | 43% | |
| Infant gender | | | | | | |
|   Boy | 70 | 60 | 50% | 10 | 50% | 0.24 |
|   Girl | 78 | 60 | 50% | 18 | 50% | |
| History of abortion | | | | | | |
|   Yes | 21 | 18 | 15% | 3 | 11% | 0.77 |
|   No | 127 | 102 | 85% | 25 | 89% | |
| Place of delivery | | | | | | |
|   Government hospital | 109 | 89 | 74% | 20 | 15% | 0.81 |
|   Private hospital | 39 | 31 | 26% | 8 | 85% | |

* Normal birth weight: 2500 – 4000 grams, Low birth weight: Less than 2500 grams

**Table 3.** Logistic regression predicting participants postnatal depression

| | *Estimate* | *SE* | *t* | *p* |
|---|---|---|---|---|
| Step 1: | | | | |
|   Husband's education (HE) | -3.02 | 0.80 | 3.79 | 0.00022** |
|   Family type | 0.85 | 1.46 | 0.58 | 0.56 |
|   Abortion history | 0.20 | 1.10 | 0.18 | 0.86 |
|   ANC follow-up | -0.54 | 1.041 | 0.52 | 0.60 |
|   Infant gender | 0.64 | 0.77 | 0.83 | 0.41 |
| | | | | |
| Step 2: | | | | |
|   HE x Family type | -7.31 | 2.87 | 2.55 | 0.01 |
|   HE x Abortion history | 1.73 | 2.45 | 0.71 | 0.48 |
|   HE x ANC follow-up | 0.28 | 2.05 | 0.14 | 0.89 |
|   HE x Infant gender | 1.70 | 1.59 | 1.07 | 0.29 |

Based on the PHQ-9 score of ≥10, 18.9% (n=28) of the women in the sample were considered to have PND. Among the sociodemographic and obstetric characteristics assessed, only the husband's education was inversely and significantly associated with participants' depression status during the postnatal period ($X^2 = 13.26$, $p = 0.01$; Table 1 & Table 2). To evaluate how well the spouse's educational levels predicted PND, we constructed a logistic regression model. A binary variable was created for the husband's education (below high school being the reference group). The model included the participant's age (mean-centered), husband's education level (below high school vs. high school and above), and the interaction term between the two as predictors, with the participant's PND status as a dependent variable (residual deviance = 129.78, $df = 144$). We did not detect influential values after examining the top three outliers using Cook's distance. VIFs of all predictors were below five (age = 2.45, husband's education = 1.01, interaction term = 2.54). Having a husband with higher education (high school and above) was associated with a lower level of PND depression (Adjusted OR: 0.25; 95%CI: 0.10, 0.6). No main effect of participants' age was detected at a statistically significant level in the model, OR: 1.04; 95%CI: 0.56, 1.95). The interaction between participants' age and their husbands' education was not statistically significant (OR:1.84; 95%CI:0.80, 4.2).

## DISCUSSION

A large majority of our study participants were young, Hindu, literate women, living with their spouses and other family members and belonging to the middle-class on the socioeconomic status scale. While over half of the women had given birth for the first time, all of them had institutional deliveries at either a government or private hospital. A majority reported needing additional antenatal check-ups and having normal vaginal deliveries, with a few delivering low birth weight infants. One-fifth of our participants screened positive for PND, and this outcome was associated with their husbands' education levels.

In our study of young women from rural India with singleton deliveries, the prevalence of depression at 16 to 20 weeks postpartum was 19%, and this was comparable to the rates reported in another study of rural women in Karnataka[9], and in the neighbouring state of Tamil Nadu.[1] In contrast, the prevalence of postpartum depression varied in studies carried out in other states of Southern India, especially in rural communities.[1,19,20,43] These studies have reported very high or low PND prevalence compared to the present study. In a study conducted among 102 postnatal mothers in rural Karnataka between the 4th and 10th week postpartum, the prevalence of PND using the Edinburgh Postnatal Depression Scale (EPDS) was found to be 31.4%.[20] Another cohort study carried out in rural Tamil Nadu employed the Revised Clinical Interview Schedule (CIS-R) among 359 postnatal mothers and reported the prevalence of PND at 11%, which was lower than what was found in the present study.[1] Hospital-based studies carried out in the urban setting in India have reported a lower prevalence of PND ranging from 6% to 12%.[18] A meta-analysis by Upadhyay et al, (2017) of PND in India estimated the highest PND prevalence of 26% in the southern region followed by eastern (23%), south-western (23%), western (21%) and northern (15%) regions of India.[12] This variation in the prevalence of depression among postnatal mothers could be due to the use of different screening tools, varying criteria to diagnose the conditions in different studies. This study used PHQ-9,

whereas other studies used different scales with the EPDS[35,46] being one of the most commonly used tools to screen for PND.[5] It is also worth noting that there are differences in the methodologies, duration after delivery at which studies were conducted, cultural factors, and geographical locations of the studies.[12,38] Participants' ability to identify and report symptoms, economic status, and lack of healthcare facilities might have also contributed to the variation observed.

The strongest determinant of postpartum depression in the present study was the husband's education level. It is possible that men with lower levels of education were more likely to have limited knowledge about pregnancy, childbirth and mental health, and thus providing less social and emotional support, which may have increased the odds of depression in the postnatal period in the women. In a 2017 systematic review and meta-analysis, a lack of psychosocial support from the husband was identified as a common risk factor for postpartum depression in India.[12] Therefore, educating new mothers and their husbands about PND, its symptoms and the importance of seeking help becomes essential. Although the effect was marginally significant, this study also found that younger mothers were less likely to have depression compared to older mothers. It is possible that older women may be perceived as more experienced and independent, and thus receive less support and care from their extended families and communities. Our results are consistent with subgroup analysis of Upadhyay and colleagues' meta-analysis. Upadhyay *et al* reported a slightly higher prevalence of postpartum depression in studies where mothers' mean age was above 25 years, compared to younger mothers.[12] Women's age was not a significant moderator in the association between the husband's education and PND. However, it is worth noting that older women, having more life experiences, may be better equipped to endure challenges in their post-natal period even when spousal support is lacking.

This study was not without limitations. The major limitation of the present study was the small sample size. Additionally, the lack of measures for specific interactions (e.g., marital conflict, domestic violence) and processes (e.g., change of depression symptoms and outcomes) limits our ability to identify the temporal associations and make causal inferences. There is a need for conducting longitudinal studies examining specific husband-wife interactions that are associated with symptoms, and the ability to perform activities/tasks among women in the postnatal period. Our study was also limited by a lack of information on participants' psychiatric history as previous history of psychiatric illness is a significant predictor for postpartum depression.[12] Although sociodemographic, cultural, and obstetric determinants were examined in this study, biological markers, such as cortisol and oxytocin levels, that may also significantly be associated with postpartum depression were not included. Among those with a history of major depressive disorder, mood symptoms specifically due to hormonal changes in the postpartum period are not frequently reported.[2] Finally, although PHQ-9 is a widely used screening tool for depression, it is worth noting that elevated symptoms do not equal a diagnosis according to the Diagnostic Statistical Manual. Future studies should measure beyond symptom severity, such as global functioning, domain-specific impairments, and quality of life.

Despite these limitations, the current study has its strengths. As study participants were recruited early during their pregnancy, they were familiar with the study interviewers. Follow-up interviews were conducted between 16 to 20 weeks postpartum. Established rapport and trust with research staff during pregnancy may have made participants feel more comfortable to honestly report their

depressive symptoms and other obstetric information. More importantly, information on the prevalence and risk factors of PND in rural settings of Mysore is important empirical evidence to help establish and implement cost-effective prevention and intervention programs to promote maternal mental health in rural settings as this greatly influences infant development. Psychoeducation programs engaging marital partners during and immediately after pregnancy may especially be beneficial for women with little social support from their husbands and immediate family members. Furthermore, screening for depression should be an integral part of pre- and postnatal care in public and private healthcare sectors. Engaging frontline health workers such as Auxiliary Nurse Midwives (ANMs) and Accredited Social Health Activists (ASHAs) to support women at risk for postpartum depression is among the most scalable options in rural India as part of the Chronic Disease Management program. For example, conducting workshops for healthcare workers (ANMs and ASHAs) to improve their understanding of PND and effective ways of supporting affected women.

In summary, one-in-five postpartum women reported having PND in rural India and the husband's education was significantly associated with the participant's depression status during the postnatal period. The factors commonly reported as significant correlates of PND in other studies, such as gender of offspring, number of pregnancies and socio-economic status, were not associated with PND in the present study. High prevalence of PND in rural communities demands early screening for mental health, evidence-based prevention and intervention programs at primary health care centres. Engaging community leaders in a campaign to promote awareness about the significance

of mental health during and after pregnancy might also be beneficial. Also, community support groups in rural regions where moms can discuss their experiences and receive emotional support might be useful. Furthermore, our findings indicate the need for studies regarding the husband's level of understanding of PND, and attitudes immediately after delivery.[39] Additionally, capacity building for frontline health workers such as ANMs and ASHAs who work closely with pregnant and postnatal mothers in rural communities is essential and urgently needed. Plus, in this digital age, conducting awareness campaigns to educate the public about PND through local media, social media, and community events might be useful.

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