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ORIGINAL ARTICLE

Postnatal depression and infant growth and development in low income countries: a cohort study from Goa, India

V Patel, N DeSouza M Rodrigues

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See end of article for authors' affiliations

Correspondence to: Dr V Patel, Sangath Centre, 841/1 Alto Porvorim, Goa 403521, India; vikpat@goatelecom.com

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Background: Postnatal depression is a recognised cause of delayed cognitive development in infants in developed countries. Being underweight is common in South Asia.
Aims: To determine whether postnatal depression contributes to poor growth and development outcomes in Goa, India.
Methods: Cohort study for growth outcomes with nested case-control study for developmental outcomes. A total of 171 babies were weighed and measured at 6–8 weeks following birth. The following measures were used: Edinburgh Postnatal Depression Scale for maternal mood, and sociodemographic and infant health variables. Outcome measures were: weight (<5th centile), length (<5th centile), and Developmental Assessment Scale for Indian Infants scores at six months.
Results: Postnatal depression was a strong, and independent, predictor of low weight and length and was significantly associated with adverse mental development quotient scores.
Conclusions: This study provides evidence for the first time that postnatal depression, a potentially treatable disorder, is a cause of poor growth and development in South Asia.

Postnatal depression (PND) is a psychological disorder which occurs within six weeks after childbirth. It is a serious mental health problem for women and its consequences have important implications for the welfare of the family and the development of the child.[1] A meta-analysis has shown an average prevalence of 13% (95% CI 12.3 to 13.4).[2] There is a large, and compelling body of evidence implicating PND with adverse child development outcomes, particularly cognitive development.[3 4] All the published literature on the impact of PND on infant development is from developed countries.

Two hypotheses were tested in this study. First, we wished to replicate the well known association between PND and development in the setting of a low income country. Second, we wished to test the hypothesis that PND in the mother at 6–8 weeks after childbirth is a risk factor for poor growth outcomes at 6 months. The rationale behind the hypothesis is that if PND is linked to adverse developmental outcomes, it could be a risk factor for poor growth in developing countries where awareness of mental health problems is low and rates of undernutrition high. This would be especially relevant in regions like Goa which have relatively better economic standards relative to other states in India, but continue to experience persistently high levels of undernutrition.[5]

METHODS

The study hospital was a district hospital in the state of Goa in India, with a catchment population of urban women living in the town of Mapusa and rural women from neighbouring villages. As with other public hospitals in India, patients are drawn from the lower socioeconomic strata. A cohort study design was used to test the growth outcome hypothesis; nested in the cohort was a case-control study of developmental outcomes. The sample consisted of consecutive babies whose mothers were participating in a study of PND and who were brought to the hospital immunisation clinic at 6–8 weeks.[6] Of the 171 babies recruited in this manner, 37 had mothers who were suffering from PND (22%) and 134 had mothers who were not depressed (78%). Babies were weighed and measured on recruitment.

The following data were collected from mothers at recruitment: sociodemographic data, including maternal and paternal education; infant data (prematurity, gender, birth weight, hospital admissions, sickness episodes); and feeding history. Mothers were also interviewed using the Edinburgh Postnatal Depression Scale (EPDS), a 10 item questionnaire specifically developed to measure maternal mood in the postnatal period.[7] Versions of the EPDS in Konkani, the most widely spoken language of Goa, were developed by translation, back-translation, consensus and field testing. A cut off score of 11/12 was found to detect caseness of PND with acceptable sensitivity and specificity.[6] Using the EPDS, 23% of mothers were found to be suffering from depression.

Outcomes were measured at 6 months. Growth outcomes (weight and length) were carried out by clinical psychologists who had been trained by the second author using interobserver measurements in an immunisation clinic.[8] Weight was recorded on a spring balance to the nearest 50 g. Length was measured using an infantometer, to the nearest 0.1 cm. Weight for age and length for age percentiles were computed using Epinut anthropometry software (World Health Organisation, 1994). Babies whose weight and length fell below the 5th centile for age were considered to be underweight and short for age respectively.[9] Corrected age was used for the assessment of growth when the baby was premature.[10]

Babies whose mothers were depressed (cases) and a subsample of controls (selected as the next infant recruited after a case) were invited to participate in an examination with the Developmental Assessment Scale for Indian Infants (DASII)[11] at 6 months. This is a standardised developmental test that has been derived from Indian norms, based on the Bayley Scales of Infant Development.[12] The DASII can be used for the assessment of motor and mental development of babies from 0 to 30 months of age. Independent motor and

Abbreviations: CI, confidence interval; DASII, Developmental Assessment Scale for Indian Infants; EPDS, Edinburgh Postnatal Depression Scale; MeDQ, mental development quotient; MoDQ, motor development quotient; PND, postnatal depression; RR, risk ratio

Table 1 Adjusted analyses for PND and infant growth outcomes

Variable	% of babies*	<5th centile weight at 6 weeks; adjusted OR for PND†	<5th centile length at 6 weeks; adjusted OR for PND†	<5th centile weight at 6 months; adjusted OR for PND†	<5th centile length at 6 months; adjusted OR for PND†
Female sex of baby	49	3.3, 1.2 to 8.6 0.01	2.3, 0.7 to 7.6 0.1	2.9, 1.1 to 7 0.01	3.6, 1.3 to 9.8 0.01
Birth weight <5th centile‡	11	3.2, 1.1 to 9.4 0.03	1.9, 0.5 to 6.8 0.2	2.8, 1.1 to 7.3 0.02	3.2, 1.1 to 8.9 0.02
Father completed school	44	2.5, 0.9 to 7.2, 0.07	2, 0.5 to 7.4 0.2	3.6, 1.4 to 9.4 0.009	3.8, 1.3 to 10.9 0.01
Mother completed school	25	3.2, 1.2 to 8.4 0.01	2.3, 0.7 to 7.3 0.1	2.7, 1.1 to 6.7 0.03	3.2, 1.1 to 8.7 0.02
Exclusively breast fed	77	3.2, 1.2 to 8.4 0.01	2.1, 0.7 to 7 0.2	2.7, 1.1 to 6.6 0.03	3.2, 1.1 to 8.7 0.02
Baby ill in first 6 weeks	27	3.2, 1.2 to 8.3 0.01	2.3, 0.7 to 7.5 0.1	2.9, 1.2 to 7.1 0.01	3.6, 1.3 to 9.7 0.01
Prematurity	3	3.1, 1.2 to 8.2 0.01	2.2, 0.7 to 7.1 0.1	2.9, 1.2 to 7.2 0.01	3.6, 1.3 to 9.9 0.01

*This column provides proportions for the whole cohort of babies.
†Results expressed as odds ratios with 95% CI and two tailed significance test values.
‡For full term babies only.

mental developmental quotients are generated based on the performance of the baby during testing. The DASII was administered blind to the mental health status of the mother.

Univariate analyses were conducted to examine the association between growth outcomes and PND. Odds ratios and 95% confidence intervals were then computed for this association after adjustment for seven variables recognised to be associated with poor growth outcomes: prematurity; gender of the baby; paternal and maternal education (school completer or not); birth weight (below or above 5th centile); breast feeding practice (exclusive or not); and infant ill health (history of hospital admission or an episode of fever, diarrhoea, or vomiting in the first 6–8 weeks) (table 1). Multiple logistic regression was carried out using Stata version 6 (Stata Corporation, USA). In the nested case-control study of developmental outcomes, the motor (MoDQ) and mental (MeDQ) developmental quotients were calculated for each baby and analysed as categorical and continuous variables (table 2). For categorical outcomes, a developmental quotient below 85 was indicative of developmental delay in an individual baby following norms used in other Indian studies.[13] All significance tests are two tailed.

RESULTS

Sample

The sample consisted of 171 babies. The average age of recruitment was 7.4 weeks. Just over half were boys (51%). Most babies were born at term (97%) and by normal vaginal delivery (83%); 71 (41%) were first children. The average maternal age was 26 years (range 18–37). Average birth weight was 2.9 kg (SD 0.44). All babies were weighed at recruitment; 30 (18%) were underweight. A total of 163 babies were measured; 14 (9%) were short for age. A total of 142 babies were weighed and measured at 6 months; 25 (17%) were underweight and 19 (13%) were short for age.

Growth outcomes

A higher proportion of babies in the PND group of mothers were underweight at birth, though this difference was not statistically significant (13% *v* 9%, p = 0.4). At 6 weeks, a higher proportion of babies in the PND mother group were underweight (24% *v* 9%, p = 0.01) and short for age (15% vs 7%, p = 0.1). On univariate analysis, PND was strongly associated with being underweight at 6 months (30% *v* 12%, risk ratio (RR) 2.3, 95% confidence intervals (CI) 1.1 to 4.7, p = 0.01) and with being short for age (25% *v* 8%; RR 2.9, 95% CI 1.3 to 6.8, p = 0.008). Table 2 shows that these associations remained statistically significant after adjustment for other variables which influence infant growth.

Developmental outcomes

Eighty nine babies were examined using the DASII; 43 babies were from the group whose mothers were depressed (case group) and 46 babies were from the non-depressed group (control group). There were no statistically significant differences between the two groups on these key variables: gender of the baby; maternal employment status; maternal age and gravidity. However, babies in the case group were more likely to be underweight at birth (p = 0.03). Babies in the case group had significantly worse mental development scores, even after adjustment for birth weight and maternal education (tables 2 and 3).

DISCUSSION

This study shows that PND was associated with significantly poorer growth outcomes at 6 months, even after adjustment for other determinants of poor growth such as low birth

Table 2 Developmental quotients (DQ) of babies whose mothers were depressed at 6 weeks postnatally compared to a group whose mothers were not depressed: DQ as categorical measure

Outcome	Proportion in index versus control	OR*	OR for PND adjusted for birth weight	OR for PND adjusted for birth weight and maternal education
Mental DQ <85	44% *v* 20%	3.2, 1.3 to 8.4 0.01	2.7, 1 to 7.3 0.04	3.3, 1.2 to 8.8 0.02
Motor DQ <85	49% *v* 43%	1.2, 0.5 to 2.8 0.6	1.3, 0.5 to 3 0.5	1, 0.4 to 2.4 0.9

*Results expressed as odds ratios with 95% CI and two tailed significance test values.

Table 3 Developmental quotients (DQ) of babies whose mothers were depressed at 6 weeks postnatally compared to a group whose mothers were not depressed: DQ as continuous measure

Outcome	Mean (95%CI) for index group	Mean (95%CI) for control group	Two tailed p value
Mental DQ	86.4 (84.1 to 88.8)	90.3 (87.7 to 92.9)	0.02
Motor DQ	84.6 (81.7 to 87.6)	88.4 (85.3 to 91.5)	0.07

weight and low parental education. Delayed mental development was also associated with PND. Thus, both the study hypotheses were found to be correct. To the best of our knowledge, this is the first study showing a linkage between PND and adverse infant growth outcomes in a low income country. The sample was drawn from a catchment area population of women attending a district maternity service. The case-control study of developmental outcomes was nested in a cohort, reducing the risk of bias imposed by retrospective recall in cross sectional designs. Infant developmental assessments were undertaken using a test standardised for Indian infants, by experienced examiners who were blind to maternal mental health status. The limitation of the study is that the population sampled was not representative of all mothers in the study area; in particular, it excludes mothers whose pregnancies were complicated and would have been referred to a tertiary medical centre. Mothers choosing private health care were also not included. Another limitation was that maternal IQ, which has a direct bearing on developmental outcomes, was not studied. However, maternal educational achievement was determined and controlled for in the analyses. Despite these limitations and the relatively small sample size, the null hypothesis in relation to growth and development outcomes was rejected. However, it is possible that there could be an independent, unmeasured, variable which may cofound the association we have reported

There is a growing body of evidence which explains how PND may impair infant growth. It is well recognised that depression is a profoundly disabling disorder, which is often unrecognised and untreated in low income countries.[14] Typically, features of depression include fatigue and tiredness, sleep difficulties, loss of appetite and weight, poor concentration, and a loss of interest in daily activities. Such features may seriously impair the mothering role; for example, by raising the probability that the mother may stop nursing the infant. Breast feeding problems were significantly more commonly reported by depressed mothers in a cohort study of mothers; top feeding before the 6–8 week review was more common in this group.[6] Early cessation of exclusive breast feeding has been identified as a key factor in infant undernutrition,[15] and may play the mediating role in explaining why infants of depressed mothers have poorer growth outcomes. Depressed mothers are also emotionally unavailable to their babies, and this can lead to psychosocial deprivation and non-organic failure to thrive.

While several studies from developed countries have shown the relation between PND and adverse infant mental development, there is only one other published study from a developing country.[16] A variety of factors have been suggested as mediating mechanisms between PND and adverse infant development.[17] These can be grouped in three causal pathways: first, poorer development may be the result of direct exposure to mother's depressive symptoms; second, development may be adversely affected by parenting difficulties, such as mother's interactive style, associated with maternal depression; and third, risk factors for PND, such as poverty may also be independent risk factors for adverse infant development. It is not possible to study the relative role of the first two causal mechanisms in the present study. The third causal pathway was investigated by including, with PND, hunger, maternal literacy, and measures of marital discord (for example, violence) in logistic regression analyses. PND remained independently associated with poorer mental development in these analyses, suggesting a direct relation through either of the first two causal pathways.

The implications of the findings of this study are that PND, a potentially treatable illness, may be a cause for poor growth outcomes and poor infant development in South Asia. Keeping in mind the limitations of this study, there is a need to replicate the study in different populations. There is a growing body of evidence that brief counselling interventions can help prevent and treat PND.[18 19] Transferring evidence of the efficacy of such interventions in the considerably different environment and cultures of low income countries may not be possible because of a number of factors.[20] Thus, there is a need to conduct controlled trials of interventions delivered to parents to evaluate their efficacy in preventing PND and associated adverse infant outcomes. Such a trial is currently in progress in Goa.

This study shows a clear linkage between depression, a mental disorder of global public health significance,[14] with poor infant growth, a major public health priority in many developing countries. It provides a rationale for integrating mental health, largely ignored by public health policy in developing countries, within the scope of maternal and child health services. Providing training on the recognition and management of PND may now serve the twin purposes of alleviating distress in mothers and reducing the rates of poor growth.

Key messages

- Postnatal depression may be a cause of poor growth outcomes in infants at 6 months in South Asia; this study has reported a strong association after adjustment for a number of possible confounders, but cannot rule out the role of an unmeasured variable
- Postnatal depression is associated with significantly poorer achievements of mental development in infants at 6 months
- This study provides evidence for a new, potentially treatable, cause for poor infant growth outcomes from a region which has the highest poor growth outcomes rates in the world
- Assessment and management of postnatal depression must be an integral part of antenatal and infant clinics in South Asia

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Authors' affiliations
V Patel, N DeSouza M Rodrigues, Sangath Centre for Child Development & Family Guidance, Goa 403521, India

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