

Maternal depression and infant growth and development in British Pakistani women: a cohort study

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ABSTRACT

Objectives: Perinatal depression has been found to be a strong and independent risk factor for poor child growth and development in low-income South Asian populations. The authors aimed to study if there was a similar association in first and second-generation British women of Pakistani origin.

Design: A prospective cohort study.

Setting: The study was conducted in the North-West of England, in areas with high density of Pakistani-origin population. The subjects were recruited from Central Manchester Hospital in the City of Manchester and East Lancashire Hospital in Lancashire.

Participants: 704 physically healthy women were assessed in two phases (screening and detailed assessment of high scorers and a proportion of low scorers) during the third trimester of pregnancy to obtain at birth a cohort of 63 infants of depressed mothers and 173 infants of psychologically well mothers.

Primary and secondary outcome measures: All infants were weighed and measured at birth and 6 months, and their development was assessed using the Bayley Scales of Infant Development—Third Edition.

Results: There was no difference in the birth weight or weight and height at 6 months of infants of depressed mothers versus infants of psychologically well mothers. The only significant difference between the two groups was in the infants' adaptive behaviour; infants of depressed mothers scored significantly lower than those of psychologically well mothers (mean difference 4.6, $t=2.81$, $df\ 195$, $p=0.006$). The associations remained significant after adjustment for socio-demographic factors by multivariate analyses.

Conclusions: Prenatal depression is not associated with impaired growth in this sample of British Pakistani women. There is, however, an association of prenatal depression with parent-reported problems in the infants' adaptive behaviour. Further research is needed to understand various pathways through which maternal depression affects infant outcomes in low- and high-income settings.

ARTICLE SUMMARY

Article focus

- In South Asian countries, maternal depression has been identified as a strong risk factor for undernutrition and stunted growth in infants.
- Maternal depression has also been associated with insecure attachment styles and deficiencies in cognitive development.
- In a longitudinal cohort design, this article examines the potential association between prenatal maternal depression and infant development, in a sample of British women of Pakistani origin.

Key messages

- The present sample of British Pakistani women show lower rates of depression as compared with the women living in Pakistan.
- Prenatal depression was not found to be associated with infant undernutrition or stunted growth. On the other hand, there was a significant association between prenatal depression and the infant's adaptive behaviour, as measured by Bayley Scales of Infant Development—Third Edition.

Strengths and limitations of this study

- The longitudinal prospective cohort design employed in this study was well suited to address the research question. Engaging the prospective sample through culturally appropriate channels and informants helped to achieve high follow-up rates.
- Due to resource and time limitations, the required sample size for the group of depressed women could not be achieved.

INTRODUCTION

Recent meta-analyses show that maternal depression is a risk factor for low birth weight and early childhood underweight and stunting in low- and middle-income countries.^{1 2} Maternal depression appears to be a particularly strong and independent risk factor for infant under nutrition in South Asian countries,³ where 30%–40% of all

children under 5 are underweight or stunted.⁴ Our longitudinal cohort study in rural Pakistan⁵ found that the RR at 6 months for infants of mothers who were depressed during pregnancy being underweight or stunted (weight-for-age z (WAZ) or length-for-age z score < -2 SD) were 4.0 (95% CI 2.1 to 7.7) and 4.4 (95% CI 1.7 to 11.4), respectively. These associations remained significant after adjustment for confounders. The population attributable risk estimate indicated that if the Pakistani infant population was unexposed to maternal depression, 30% (95% CI 19% to 41%) fewer children would be stunted. Furthermore, studies show that infants of depressed mothers are less likely to be securely attached and more likely to have behavioural problems and poor cognitive development.⁶ Globally, maternal depression has been called a major threat to optimal child development and calls have been made to address it at a public health level.^{6 7}

Evidence from high-income countries is less equivocal.⁸ However, most studies have been conducted in the general population. Considering that the rates of maternal depression in Pakistani women are also higher—a recent population-based study in the North-West of England⁹ found depression prevalence in British Pakistani women was 31% compared with 18% in white European women—and given such strong and independent associations with infant under nutrition in South Asia, it would be important to explore its association with poor infant growth and development in this population.

The aim of this study was to systematically investigate the association of antenatal maternal depression and infant growth and other development parameters in a representative community-based sample in the North-West of England, using a longitudinal prospective cohort design.

METHODS

Participants

The study was conducted in North-West England. Subjects were recruited from two maternity hospitals in areas with high density of Pakistani-origin population—Central Manchester Hospital in the City of Manchester and East Lancashire Hospital in Lancashire. Furthermore, over 80% of the Pakistani-origin women in the study area migrated from the Potohar and Mirpur region of Pakistan, the same area where we conducted our Pakistan studies,^{10–12} allowing a direct comparison between populations that are ethnically similar. From August 2006 to July 2008, all British women of Pakistani origin presenting to these maternity hospitals for their antenatal check-ups, and who consented to take part in the research, were invited to participate. Our definition of ethnicity required a strict three from four grandparents to share the same ethnic group and was also self-defined using Census categories. Exclusions were women with multiple pregnancies, diagnosed physical or learning disability, post-partum or other psychosis and

following delivery, infants born prematurely, with congenital deformity, physical or mental handicap.

Measurements

Assessment of maternal depression

Informed written consent was obtained from all participants. A two-phase procedure was used to diagnose depression in the women who consented and met the inclusion criteria. In the first phase, all participating women were administered the Edinburgh Postnatal Depression Scale (EPDS).¹³ This is the most widely used tool to screen for probable cases of perinatal depression and has been found to have excellent psychometric properties cross-culturally and in the Pakistani population.¹⁴ A commonly used cut-off score of 12 or more was used to distinguish between the probable depressed and non-depressed cases. The women were approached in an antenatal clinic and all those in the third trimester of their pregnancy, who gave consent, were screened using the EPDS. All women scoring over 12 and a one in seven random sample of low-scoring women were invited for further assessment of their mental state with a diagnostic interview using the Schedules for Assessment in Neuropsychiatry (SCAN).¹⁵ SCAN is an internationally validated semi-structured interview generating International Classification of Diseases, 10th Revision diagnoses of depressive disorder. All interviews were carried out by trained and experienced clinicians.

Assessment of infant growth and development

Infant growth measurements were carried out using standard anthropometric techniques and equipment.¹⁶ Measurements were carried out at birth, 3 and 6 months postnatal. Growth data were converted into SD (z scores) for weight and length using Epi Info 2002 software (Centers for Disease Control). Infants were classified as underweight or stunted if their WAZ scores or length-for-age z scores were < -2 , on the basis of the National Center for Health Statistics/WHO reference data.¹⁷

Bayley Scales of Infant Development—Third Edition (BSID-III) were used to assess infant development.¹⁸ The BSID-III yield composite scores reflecting infants' cognitive, language, motor, socioemotional and adaptive behavioural development. Three of these content domains—cognitive, language and motor—are assessed by items administered to the child, whereas the social-emotional and adaptive behaviour domains are based on information supplied by the primary care giver to items contained in a separate questionnaire. A standard score is derived for each scale, with a mean of 100 and a SD of 15. This instrument has excellent psychometric properties and has been validated on over 1700 children. The BSID-III was administered by a single trained research assistant.

All instruments have been previously adapted for use in the Pakistani population and the researcher doing the assessments was trained by an expert experienced in their use in Pakistani infants.

Assessment of socio-demographic and other factors

Data on selected socio-demographic factors of interest were collected through a specially developed Personal Information Questionnaire. The factors included age, marital status, education, any self-reported health problem, whether first- or second-generation immigrant, pregnancy planned or unplanned and number of children.

Sample size and statistical analysis

Assuming the SD of birth weight is 500 g, a sample of 100 depressed and 100 non-depressed women would give the study 80% power to detect a difference in the mean birth weight between groups of 200 g at the 5% significance level. Assuming, from previous South Asian data,¹⁹ a correlation coefficient between EPDS score and change in weight of 0.15, an SD of weight change of 400 g and an SD of 5 for EPDS scores, 100 women in each group will allow the study to detect a difference in growth of 20 g for each 1-unit increase in EPDS score.

Mean differences in birthweight WAZ and height-for-age z (HAZ) scores at 6 months between the exposed group (infants of prenatally depressed mothers) and the non-exposed group (infants of prenatally non-depressed mothers) were analysed using growth indices as continuous measures. Similar analyses were carried out for the Bayley's composite scores in the cognitive, language, motor, socioemotional and adaptive behaviour domains. For each outcome, multiple regression analysis was used to simultaneously control for the confounding effects of all the variables under study. Pearson correlation was used to examine the association between the EPDS score

and the anthropometric outcomes at 6 months for each gender separately.

RESULTS

Figure 1 shows the flow of participants in this study. Altogether 714 women meeting the study criteria were interviewed with the EPDS, of whom 261 (36.6%) scored 12 or more. Of these, 191 (73.2%) went into the main study. Reasons why 70 did not are as follows: the baby was delivered before an interview took place for 30, two babies died, 11 mothers refused, 11 were unavailable, 11 could not be contacted and five were not asked. A random selection of 67 (14.8%) of the low EPDS scorers were asked for the main interview, and 46 of these (69%) completed interviews. Of the 21 who did not, three babies were delivered before the interview, two mothers refused, 15 were unavailable and one could not be contacted. Out of the 191 high EPDS scorers, 59 (30.9%) were found to be depressed on the SCAN interview, and four out of the 46 low scorers were depressed (8.7%). The weighted prevalence of depression in this group of pregnant Pakistani women was 16.8% (95% CI 14.1% to 19.6%). The remaining 132 high EPDS scorers who did not exhibit signs of depression on the SCAN interview were grouped with the 42 low scorers to form the group non-depressed mothers. Thus, the depressed group consisted of 63 mothers and the control group consisted of 174 non-depressed mothers.

The 6 months postnatal follow-up data were secured on 208 (87.8%) of the total of 237 participants with complete baseline data. The mothers (29) who were not followed up, the reasons were as follows: eight moved

Figure 1 Flow chart of participants through two-phase antenatal screen and interviews. EPDS, Edinburgh Postnatal Depression Scale; SCAN, Schedules for Assessment in Neuropsychiatry.

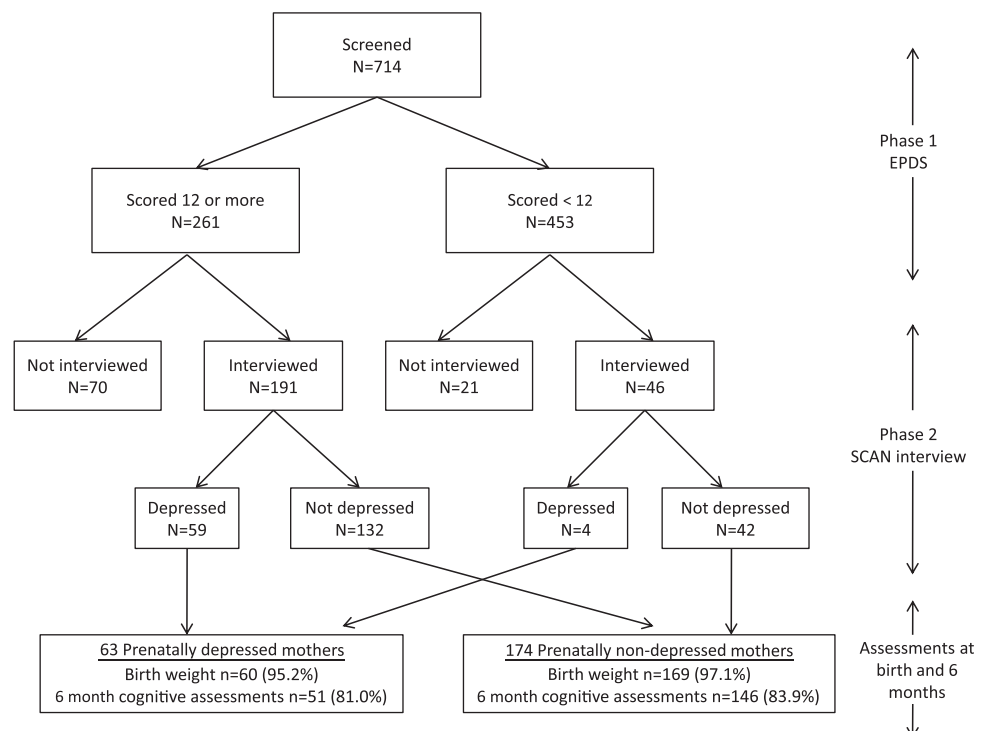


Table 1 Comparison of socio-demographic factors between depressed and non-depressed women*

Socio-demographic factors	Depressed (n=63), % (n)	Not depressed (n=174), % (n)
First-generation Pakistani	77.8% (49)	81.6% (142)
Educated to A-level or more	54.0% (34)	54.0% (94)
Married	95.2% (60)	97.7% (170)
Planned pregnancy	42.6% (26)	45.7% (69)
Primigravida	28.2% (19)	28.2% (49)
≥2 children	49.2% (31)	41.4% (72)
Marked health difficulty	1.6% (1)	0% (0)
Age, mean (SD)	28.5 (5.0)	28.6 (5.1)

*First-generation Pakistani: women born outside the UK; second-generation Pakistani: women born in the UK.

away, three withdrew because of the baby's poor health, one baby died, nine lost contact, one withdrew because of her mother's health difficulties, five were not available and two refused.

Table 1 compares the socio-demographic characteristics between the depressed and non-depressed groups. Women in the depressed group were less likely to be first-generation Pakistani and more likely to have more than two children; they were similar to the non-depressed women in the other factors measured.

Only 19 (8%) of the infants had low birth weight (≤ 2500 g). Only four (2%) of the infants' were below -2 SD weight-for-age and 2 (1%) were below -2 SD length-for-age at 6 months, indicating that the prevalence of underweight or stunting in our sample was very low.

Table 2 shows differences in birth weight and mean WAZ and HAZ of infants at 6 months in the two groups. None of the differences is significant.

We analysed the data using EPDS scores as a continuous measure and after stratifying for gender of the infant. The correlation coefficient for the female infants for WAZ was -0.16 ($p=0.11$) and for HAZ was -0.15 ($p=0.15$). The corresponding statistics for male infants were -0.08 ($p=0.5$) and -0.11 ($p=0.37$), indicating that there was no association between the EPDS scores and growth of the infants.

Table 3 shows the difference between the infants of depressed and non-depressed mothers in the composite scores on the cognitive, language, motor and behavioural dimensions of the Bayley's Scales of Infant Development at 6 months. The only score where there was a significant difference between the two groups was adaptive behaviour, with the infants of depressed mothers scoring lower than the infants of non-depressed mothers (mean difference 4.6, $t=2.81$, df 195, $p=0.006$).

Multiple regression for each of the Bayley's scores and for weight and height for age at baseline adjusting for all variables listed in table 1 showed that the effects of mother's depression remained unchanged. The unstandardised regression coefficient for non-depressed versus depressed for the adaptive behaviour composite score was 5.35, SE 1.73, $p=0.002$. There were no significant effects of mother's depression on any of the other Bayley's scores, or birth weight, or WAZ or HAZ at 6 months, after adjusting for these covariates.

DISCUSSION

This study was conducted on a sample of British women of Pakistani origin, the great majority of whom had migrated from the same geographical region where we conducted a similar study in Pakistan,⁵ allowing us to make direct comparisons between the two samples. The prevalence of prenatal depression in this sample of British Pakistani women is about 17%, which is slightly higher than the 10%–15% reported in the general population²⁰ but lower than the 28% reported in the Pakistani sample.¹¹ The infant growth parameters were strikingly different between the two populations—low birth weight in the British Pakistani sample was 8% compared with 25% in the Pakistani sample,²¹ underweight at 6 months was 2% compared with 18% in the Pakistani sample and stunting was 1% compared with 10% in the Pakistani sample.⁵ Unlike the Pakistani sample where the RR of undernutrition at 6 months with prenatal depression was 5.9 (95% CI 2.7 to 12.8), we found no association between prenatal depression and undernutrition or stunting in the British Pakistani infants. The only infant development domain to show a significant association with prenatal depression was

Table 2 Unadjusted comparison of depressed and non-depressed groups in infant anthropometric status

Variable	Depression, mean (SD) n	No depression, mean (SD) n	Difference, mean (95% CI)	p Value
Birth weight (in grams)	3204 (539) 60	3179 (559) 169	25 (–140 to 189)	0.77
WAZ at 6 months	0.19 (1.05) 49	0.13 (1.35) 140	0.06 (–0.36 to 0.48)	0.77
HAZ at 6 months	0.78 (0.82) 48	0.74 (1.06) 138	0.03 (–0.30 to 0.37)	0.85

HAZ, height-for-age z score; WAZ, weight-for-age z score.

Table 3 Comparison of depressed and non-depressed groups on Bayley's Scales of Infant Development scores

Birth measurements and scores of baby	Depressed (n=51), mean (SD)	Non-depressed (n=146), mean (SD)	t	df	p Value (t test)
Cognitive composite score	93.8 (10.4)	96.2 (9.6)	1.51	195	0.13
Language composite score	89.7 (8.7)	90.0 (8.7)	0.16	195	0.88
Motor composite score	91.1 (14.2)	93.1 (13.5)	0.88	195	0.38
Social emotional composite score	107.3 (17.9)	108.4 (16.7)	0.42	195	0.67
Adaptive behaviour composite score	95.2 (9.2)	99.8 (10.5)	2.81	195	0.006

parent-reported adaptive behaviour (communication, play, self-direction and social skills).

The strengths of the study are that it used a longitudinal cohort design, most appropriate for such an investigation, and able to achieve high follow-up rates. Studies on ethnic minority populations suffer from problems of access and recruitment but we did not encounter such problems because we engaged the communities through key informants and user friendly, culturally appropriate information leaflets. Most of our research team consisted of bilingual Pakistani-origin researchers. However, we were not able to meet our required sample size in the depressed group because of time and resource constraints, and this is a limitation that should be kept in mind when interpreting the results. However, the strikingly low levels of undernutrition in our sample and the absence of even a trend towards an association of poorer growth with prenatal depression are sufficient to derive reasonable conclusions from these data. Maternal depression, which is a strong and independent predictor of infant growth in Pakistani women, is not associated with infant growth or development in British Pakistani women.

The results are not entirely unexpected. In an earlier paper, we had argued that maternal competence in childcare, which is likely to be negatively affected by depression, probably plays a greater role in the child's physical well-being and development in impoverished settings, as the environment is frequently more hostile than in the more resourced settings.²² Overcrowding, poor sanitation and food insecurity are common, with suboptimal maternal care potentially resulting in a greater risk to the physical health of a child in such settings.

One could hypothesise that, in an environment where basic hygiene and food security is assured, the manifestations of maternal depression are different. A secondary analysis of the Millenium Cohort study provides some preliminary evidence—we have found severe psychological distress in mothers of toddlers to be associated with obesity in their children.²³ The association of maternal depression with poorer scores on adaptive behaviour might indicate a similar trend. Further studies are required to investigate the impact of maternal depression on infant development domains in well-resourced settings.

The EPDS was initially developed and validated for postnatal depression but it has been reported to be

useful for the detection of depression during pregnancy^{24–26} with good psychometric properties. We have used the EPDS during pregnancy in our studies in Pakistan²⁷ and it has been validated in the Pakistani population.¹⁴

The BSID has been used to measure child development in a variety of US populations including Hispanic and Mexican Americans and in a variety of international populations. The transcultural research has involved populations as diverse as in Bangladesh,^{28–29} Taiwan,³⁰ Nigeria³¹ and Brazil.³² These studies did not report any major difficulties in the use of BSID with diverse non-English-speaking cultures. Although BSID has been used in Pakistani population in Pakistan and people of Pakistani origin in the UK, however, it is based on Western norms. It has been debated whether or not instruments designed in one system are applicable to other cultures.

In a review in Lancet series on Global mental health³³ and a more recent systematic review and meta-analysis² include studies from South Asia which suggest that depression during pregnancy increases the risk of low birth weight and the postnatal depression is associated with infant likely to be underweight and stunted. However, there are conflicting reports from some other developing countries. In the developed world such an association is reported only in the low socioeconomic groups,⁸ and there are reports on the significant adverse effects of postnatal depression on the cognitive development and behaviour^{34–36} particularly among the boys. The adverse effects on the male infants persist long term.³⁷ A recent review by Walker and colleagues³⁸ suggests that now there is sufficient evidence linking maternal depression to adverse child development outcomes in the developing world also. Therefore, early intervention is recommended as reducing or preventing maternal depression may also be a major preventive strategy for the children.

There seems to be a paucity of research, especially in the area of mental health, in ethnic minorities living in the developed world.²⁰ Because it is difficult to include non-English-speaking mothers and children, studies that examine maternal health and child outcomes generally report results from predominantly literate English-speaking white European population.^{20–39–40} Consequently, little is known about the impact of poor mental health in ethnic minorities living in the UK. Furthermore, transcultural studies and comparative studies

between immigrants and their populations of origin could yield important epidemiological information that helps our understanding of such disorders of public health importance.

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Contributors NH, AR and JKC designed the study. SK coordinated the study and helped with ethical approval and data collection. BT did the statistical analysis. AR wrote the first draft. NH was involved throughout the project and finalised the manuscript. All authors helped to prepare the final report. NH is the guarantor.

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Competing interests None.

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Data sharing statement Technical appendix, statistical code and data set are available from the corresponding author at nusrat.husain@manchester.ac.uk.

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