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Perinatal mental distress and infant morbidity in Ethiopia: a cohort study

Joanna Ross,1 Charlotte Hanlon,2,3 Girmay Medhin,4 Atalay Alem,3 Fikru Tesfaye,5 Bogale Worku,6 Michael Dewey,2 Vikram Patel,1,7 Martin Prince2

ABSTRACT

Objectives (1) To investigate the impact of perinatal common mental disorders (CMD) in Ethiopia on the risk of key illnesses of early infancy: diarrhoea, fever and acute respiratory illnesses (ARI) and (2) to explore the potential mediating role of maternal health behaviours.

Design Population-based cohort study.

Setting Demographic surveillance site in a predominantly rural area of Ethiopia.

Participants 1065 women (86.3% of eligible) in the third trimester of pregnancy were recruited and 954 (98.6%) of surviving, singleton mother–infant pairs were followed up until 2 months after birth.

Main exposure measure High levels of CMD symptoms, as measured by the locally validated Self-Reporting Questionnaire (SRQ-20 ≥6), in pregnancy only, postnatally only and at both time-points ('persistent').

Main outcome measures Maternal report of infant illness episodes in first 2 months of life.

Results The percentages of infants reported to have experienced diarrhoea, ARI and fever were 26.0%, 25.0% and 35.1%, respectively. Persistent perinatal CMD symptoms were associated with 2.15 times (95% CI 1.39 to 3.34) increased risk of infant diarrhoea in a fully adjusted model. The strength of association was not affected by including potential mediators: breast feeding practices, hygiene, the infant’s vaccination status or impaired maternal functioning. Persistent perinatal CMD was not associated with infant ARI or fever after adjusting for confounders.

Conclusions Persistent perinatal CMD was associated with infant diarrhoea in this low-income country setting. The observed relationship was independent of maternal health-promoting practices. Future research should further explore the mechanisms underlying the observed association to inform intervention strategies.

BACKGROUND

Maternal common mental disorders (CMD), characterised by depressive, anxiety and somatic symptoms, have been associated with poorer infant outcomes. In high-income settings, infants of women with postnatal CMD are more likely to have impaired cognitive, social and emotional development.1–3 Maternal health behaviours on behalf of their infants may also be negatively affected by maternal CMD: decreased vaccination, impaired child safety behaviours4 and increased use of emergency5–7 rather than preventive services.7

What is already known on this topic

In Pakistan, maternal depression was associated with an increased RR of 2.3 (95% CI 1.6 to 3.1) of ≥5 infant diarrhoeal episodes.

Maternal common mental disorder symptoms adversely affect health behaviours, for example, breast feeding and taking a child for vaccination.

What this study adds

An association between maternal perinatal common mental disorder (CMD) and infant diarrhoea was found.

Impairment of maternal health-promoting behaviours did not appear to mediate the association between maternal perinatal CMD and infant diarrhoea.

Maternal perinatal CMD symptoms were not associated with infant acute respiratory illness or fever in Ethiopia.

The prevalence of maternal CMD varies across low- and middle-income countries (LAMICs): from 6.1% in Uganda9 to 34.5% in South Africa.10 Maternal CMD has been associated with low birth weight in some,11–13 although not all,14 LAMIC settings and a range of adverse infant outcomes: undernutrition,15–20 poorer cognitive development,16 child injury21 and increased diarrhoeal illness.22–24 In Pakistan,23 infants of mothers with postnatal depression had 2.8 times the odds of having five or more diarrhoeal episodes in their first year, after adjusting for confounders. Studies from Chile22 and Nigeria18 found similar associations with infant diarrhoeal episodes and other illnesses, although neither study adjusted for confounders. Possible mechanisms underlying the association have been postulated24 although not investigated systematically.

In this paper, we present findings from a population-based cohort, the Perinatal Maternal Mental Disorder in Ethiopia study. This study evaluated the impact of perinatal CMD upon infant episodes of diarrhoea, acute respiratory illnesses (ARI) and...

score of ≥6 on the SRQ-20. 28 CMD exposure categories were defined as high levels of CMD symptoms. Responses were summed and generating household money, attending groups, buying medication, selling crops and crops to husband. Maternal autonomy was defined according to whether the woman had to ask her husband before selling crops, spending an hour of birth, 1–8 h, between 8 and 24 h and longer than 24 h. This assessment took place a median of 2 days after birth. Time to initiation of breast feeding was categorised as: within an hour of birth, 1–8 h, between 8 and 24 h and longer than 24 h. This assessment took place a median of 2 days after birth. At 2 months after birth, women were asked about frequency of contact with friends, adequacy of help received with usual activities.

Potential mediators
Time to initiation of breast feeding was categorised as: within an hour of birth, 1–8 h, between 8 and 24 h and longer than 24 h. This assessment took place a median of 2 days after birth. At 2 months after birth, women were asked about frequency of contact with friends, adequacy of help received with usual activities.

Statistical methods
Associations between CMD exposure categories and potential confounders were explored by calculating incidence RR with 95% CI. RRs were estimated using a Poisson working model and sandwich estimators of the standard error. Multivariable analyses were conducted, initially adding groups of potential confounders and noting changes in the estimated RR for maternal CMD and infant illness episode. Subsequently all confounders, except maternal BMI, were added simultaneously to obtain the final adjusted RR. BMI was only available for 80.1% of women and so analyses were repeated with BMI included and both models presented. Potential mediators
RESULTS

Of the 1065 women recruited in pregnancy, 1006 had singleton live births (see figure 1). At the 2-month postnatal time-point, 954 (98.6%) of surviving mother–infant pairs were assessed.

The percentages of infants reported to have experienced episodes of diarrhoea, ARI and fever since birth were 26.0%, 25.0% and 35.1%, respectively. Almost half (47.2%) of the infants did not experience any of the conditions, and 6.8% experienced all three.

The majority of women (86.2%) did not experience high levels of CMD symptoms in pregnancy or during the postnatal period. Of those women with CMD symptoms, 88 (9.2%) had high CMD in pregnancy only, 20 (2.1%) in the postnatal period only and 24 (2.5%) had persistent perinatal CMD.

The crude RR for the associations between potential confounding variables and infant diarrhoea, ARI and fever are shown in table 1.

Perinatal CMD symptoms and infant diarrhoea

The presence of high CMD symptoms in the postnatal period only or during both pregnancy and the postnatal period was significantly associated with an increased crude risk of infant diarrhoea: RR 1.84 (95% CI 1.12 to 3.03) and RR 2.90 (95% CI 2.18 to 3.85), respectively. CMD symptoms during pregnancy alone were not significantly associated with increased risk of infant diarrhoea.

Individual groups of potential confounders were added into the model and the resulting changes to the RR for maternal CMD and infant diarrhoea were recorded (table 2).

CMD in the postnatal period only was associated with increased risk of infant diarrhoea except when adjusting for socio-economic status and maternal health. The association between persistent CMD and infant diarrhoea was significant for all separate groups of confounders.

When all potential confounders were adjusted for simultaneously (excluding maternal BMI), persistent maternal CMD symptoms continued to be associated with increased risk of infant diarrhoea (RR 2.15; 95% CI 1.39 to 3.34). The effect of CMD symptoms in the postnatal period alone was no longer significant. Including maternal BMI as a potential confounder led to an increase in the strength of association.

When potential mediating variables were added into the equation, there was little or no change in the strength of association between maternal CMD and infant diarrhoea.

Perinatal CMD symptoms and infant ARI and fever

Persistent CMD symptoms also appeared to increase the risk of both ARI (crude RR 2.24; 95% CI 1.52 to 3.30) and fever (crude RR 1.61; 95% CI 1.10 to 2.35), although CMD in pregnancy or in the postnatal period alone were not significantly associated with either ARI or fever (see table 3). However, these associations were confounded by socio-economic status and maternal ill-health and were no longer significant in the final fully adjusted models. As with the outcome of infant diarrhoea, addition of potential mediators did not affect the size of the association between CMD and ARI or fever (see online tables 1 and 2).

DISCUSSION

This paper extends the growing body of literature from Pakistan, Chile and Nigeria linking poor maternal mental health to increased risk of infant illness.16 22 23 In this study, persistent perinatal CMD symptoms were associated with more than double the risk of an infant diarrhoeal episode during the first 2 months of life. However, this association was not mediated by a negative impact of CMD on maternal health-promoting behaviours. No association was found between perinatal CMD and infant ARI or fever after adjusting for potential confounders.

Only when maternal CMD symptoms were persistent was a significant association with infant diarrhoeal episodes observed. We might have expected CMD symptoms with onset in the postnatal period (‘postnatal only’) to have also been associated with infant diarrhoeal episodes. Such an association was observed in the crude analyses and only decreased when adjusting for maternal physical ill-health and socio-economic status. A major limitation of our study was the small number of women with high levels of postnatal CMD symptoms, raising the possibility that we were under-powered to detect a true association. A further limitation arose from our reliance upon self-report of maternal physical ill-health simultaneously with measurement of postnatal CMD. Both negative recall bias and somatic expression of mental distress could have resulted in women with higher CMD symptoms being more likely to report somatic complaints irrespective of their true health status, leading to over-adjustment for maternal physical ill-health. This explanation is supported by the finding that inclusion of
maternal BMI, an objective indicator of maternal health status, strengthened the observed association. Moreover, when self-reported maternal ill-health was excluded from the adjusted model including BMI, CMD symptoms occurring in the postnatal period only became significantly associated with infant diarrhoea (RR 1.96; 95% CI 1.10 to 3.15).

In this analysis, maternal ill-health was conceptualised as a potential confounder of the relationship between maternal CMD and infant illness episodes, but could also have mediated the relationship. Symptoms of CMD might increase the mother’s own risk of contracting an infectious illness and thereby lead to infant ill-health, either through exposure to the mother’s pathogens or by further interfering with optimal infant care.

Maternal CMD was not associated with infant fever or ARI after adjusting for confounders. This is in keeping with the study from Pakistan but contradicts the findings from Nigeria. However, the latter study was clinic-based, did not specify which illnesses were being considered and did not control for confounders. Our finding of a differential effect of maternal CMD symptoms on risk of different infant illnesses is not altogether unexpected. The risk of developing ARI is strongly influenced by indoor air pollution and crowding, in addition to maternal health behaviours. Likewise, the risk

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**Table 1** RR for association between potential explanatory variables and the outcomes of infant diarrhoea, acute respiratory illness and fever in the first 2 months of life

<table>
<thead>
<tr>
<th>Maternal characteristics</th>
<th>N (%)</th>
<th>Diarrhoea RR (95% CI)</th>
<th>ARI RR (95% CI)</th>
<th>Fever RR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years), mean (SD)</td>
<td>26.9 (6.3)</td>
<td>1.02 (1.00 to 1.04)</td>
<td>0.99 (0.98 to 1.01)</td>
<td>1.00 (0.99 to 1.01)</td>
</tr>
<tr>
<td>Parity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primiparous</td>
<td>138 (14.5)</td>
<td>Reference</td>
<td>Reference</td>
<td>Reference</td>
</tr>
<tr>
<td>2–4 Births</td>
<td>423 (44.3)</td>
<td>1.42 (0.96 to 2.10)</td>
<td>1.06 (0.77 to 1.47)</td>
<td>0.69 (0.54 to 0.87)</td>
</tr>
<tr>
<td>5 Or more births</td>
<td>393 (41.2)</td>
<td>1.60 (1.09 to 2.36)</td>
<td>0.89 (0.64 to 1.25)</td>
<td>0.83 (0.66 to 1.05)</td>
</tr>
<tr>
<td>Level of autonomy (n=947)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Always</td>
<td>613 (64.7)</td>
<td>Reference</td>
<td>Reference</td>
<td>Reference</td>
</tr>
<tr>
<td>Sometimes</td>
<td>199 (20.0)</td>
<td>1.23 (0.95 to 1.58)</td>
<td>1.09 (0.83 to 1.42)</td>
<td>0.85 (0.67 to 1.08)</td>
</tr>
<tr>
<td>Doesn’t have to ask</td>
<td>145 (15.3)</td>
<td>0.87 (0.62 to 1.21)</td>
<td>0.82 (0.58 to 1.16)</td>
<td>0.92 (0.72 to 1.19)</td>
</tr>
<tr>
<td>Socio-economic status</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower wealth (n=952)</td>
<td>539 (56.6)</td>
<td>1.23 (0.99 to 1.54)</td>
<td>1.17 (0.94 to 1.47)</td>
<td>1.25 (1.05 to 1.50)</td>
</tr>
<tr>
<td>Hungry in last month (lack of money)</td>
<td>99 (10.4)</td>
<td>1.61 (1.23 to 2.11)</td>
<td>1.58 (1.20 to 2.11)</td>
<td>1.34 (1.06 to 1.70)</td>
</tr>
<tr>
<td>Indebted</td>
<td>77 (8.1)</td>
<td>1.69 (1.26 to 2.25)</td>
<td>1.52 (1.10 to 2.09)</td>
<td>1.37 (1.06 to 1.77)</td>
</tr>
<tr>
<td>Environment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban kebele</td>
<td>135 (14.2)</td>
<td>0.87 (0.62 to 1.20)</td>
<td>0.71 (0.49 to 1.03)</td>
<td>0.75 (0.56 to 1.01)</td>
</tr>
<tr>
<td>Infant characteristics</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Birth weight</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low (&lt;2500 g)</td>
<td>35 (3.7)</td>
<td>0.96 (0.54 to 1.72)</td>
<td>0.96 (0.54 to 1.72)</td>
<td>1.28 (0.88 to 1.88)</td>
</tr>
<tr>
<td>Not measured</td>
<td>451 (47.3)</td>
<td>1.05 (0.84 to 1.30)</td>
<td>0.86 (0.69 to 1.08)</td>
<td>0.94 (0.79 to 1.13)</td>
</tr>
<tr>
<td>Female infant</td>
<td>469 (49.2)</td>
<td>0.97 (0.78 to 1.20)</td>
<td>0.82 (0.65 to 1.02)</td>
<td>0.86 (0.72 to 1.02)</td>
</tr>
<tr>
<td>Maternal functioning impaired ≥15 days</td>
<td>75 (7.9)</td>
<td>1.20 (0.84 to 1.71)</td>
<td>1.50 (1.08 to 2.07)</td>
<td>1.20 (0.90 to 1.59)</td>
</tr>
</tbody>
</table>

n=954 singleton mother–infant pairs.
ARI, acute respiratory illness; BMI, body mass index.
of fever is influenced by a broad spectrum of factors, ranging from cramped living conditions facilitating transmission, to exposure to insect bites and poor hygiene practices. Infant diarrhoea, on the other hand, is influenced predominantly by non-exclusive breast feeding, poor hygiene practices and poor sanitation, which, in this setting, are largely dependent upon the mother’s actions.

Relying on maternal self-report could have resulted in misclassification of infant illness status. However, any such misclassification is likely to have been non-differential. Although negative recall bias could have led women with postnatal CMD to over-report infant illness, the importance of the persistent CMD exposure makes this less likely as persistent CMD incorporates CMD measured before the commencement of the postnatal period.

In previous studies from LAMICs, postnatal CMD was associated with early cessation of breast feeding, decreased vaccination and impaired mother–infant relationship, all of which could mediate an effect of maternal CMD on infant illness. However, in this study, there was no evidence that delayed initiation of breast feeding, non-exclusive breast feeding, infrequent soap use, overdue infant vaccination or impaired maternal functioning mediated the association between persistent perinatal CMD and infant illness. There are a number of possible explanations for this negative finding. Aside from the BCG vaccination, the recommended age for first infant vaccination is 6 weeks, with full protection not afforded until completion of the entire course. Therefore, at 2 months after birth, vaccination status may have explained little variation of infant illness, limiting our ability to find an association. Our reliance on self-report of maternal hygiene practices could have led to social desirability bias; direct observation of possible mediators to the fully adjusted model.

Table 2

<table>
<thead>
<tr>
<th>Maternal CMD and infant diarrhea</th>
<th>RR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SRQ ≥ 6, pregnancy only</td>
</tr>
<tr>
<td>Crude RR (n=954)</td>
<td>0.98 (0.66 to 1.44)</td>
</tr>
<tr>
<td>(1) Adjusted separately for</td>
<td></td>
</tr>
<tr>
<td>Maternal characteristics (n=947)</td>
<td>0.93 (0.67 to 1.33)</td>
</tr>
<tr>
<td>Parental education (n=947)</td>
<td>1.00 (0.68 to 1.48)</td>
</tr>
<tr>
<td>Socio-economic status (n=944)</td>
<td>0.95 (0.64 to 1.39)</td>
</tr>
<tr>
<td>Environmental conditions (n=950)</td>
<td>0.96 (0.65 to 1.41)</td>
</tr>
<tr>
<td>Maternal ill-health (n=950)</td>
<td>0.97 (0.65 to 1.44)</td>
</tr>
<tr>
<td>Maternal substance use (n=955)</td>
<td>0.96 (0.66 to 1.45)</td>
</tr>
<tr>
<td>Infant characteristics (n=955)</td>
<td>0.97 (0.66 to 1.43)</td>
</tr>
<tr>
<td>Social support (n=943)</td>
<td>0.95 (0.64 to 1.43)</td>
</tr>
</tbody>
</table>

(2) Fully adjusted models

Model A (n=925): fully adjusted (excluding BMI) 0.93 (0.63 to 1.37) 1.15 (0.65 to 2.04) 2.15 (1.39 to 3.34)
Model A+BMI (n=748) 1.06 (0.66 to 1.72) 1.66 (0.85 to 3.21) 2.34 (1.50 to 3.65)

(3) Testing for mediators

Model A+delayed breast feeding (n=910) 0.93 (0.63 to 1.37) 1.18 (0.67 to 2.09) 2.09 (1.35 to 3.24)
Model A+non-exclusive breast feeding (n=925) 0.93 (0.63 to 1.38) 1.16 (0.65 to 2.06) 2.19 (1.41 to 3.40)
Model A+soap use (n=925) 0.92 (0.62 to 1.36) 1.13 (0.63 to 2.01) 2.13 (1.37 to 3.29)
Model A+vaccination status (n=922) 0.91 (0.62 to 1.33) 1.13 (0.64 to 1.99) 2.16 (1.40 to 3.33)
Model A+maternal disability (n=925) 0.93 (0.63 to 1.37) 1.20 (0.67 to 2.14) 2.29 (1.45 to 3.61)

Infant diarrhoea (with robust standard errors) adjusting for (1) groups of confounders separately, (2) all confounders simultaneously and (3) with addition of possible mediators to the fully adjusted model.

BMI, body mass index; CMD, common mental disorder; SRQ, Self-Reporting Questionnaire.

Table 3

<table>
<thead>
<tr>
<th>Maternal CMD and infant ARI</th>
<th>RR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SRQ ≥ 6, pregnancy only</td>
</tr>
<tr>
<td>Crude RR (n=954)</td>
<td>1.03 (0.70 to 1.51)</td>
</tr>
<tr>
<td>Fully adjusted model (excluding BMI) (n=925)</td>
<td>1.09 (0.74 to 1.59)</td>
</tr>
<tr>
<td>Fully adjusted model+BMI (n=748)</td>
<td>1.17 (0.73 to 1.88)</td>
</tr>
<tr>
<td>Maternal CMD and infant fever</td>
<td></td>
</tr>
<tr>
<td>Crude RR (n=954)</td>
<td>1.18 (0.90 to 1.55)</td>
</tr>
<tr>
<td>Fully adjusted model (excluding BMI) (n=925)</td>
<td>1.08 (0.80 to 1.45)</td>
</tr>
<tr>
<td>Fully adjusted model+BMI (n=748)</td>
<td>1.24 (0.87 to 1.75)</td>
</tr>
</tbody>
</table>

ARI, acute respiratory illness; BMI, body mass index; CMD, common mental disorder; SRQ, Self-Reporting Questionnaire.
interactions.\textsuperscript{43} In South Africa, interventions from trained lay workers improved the mother–infant relationship, reduced maternal depressive symptoms and decreased insecure attachment.\textsuperscript{44} Such studies demonstrate the feasibility of intervention and could shed further light on mechanisms linking maternal CMD and infant ill-health.

**CONCLUSION**

This is the first prospective population-based study from sub-Saharan Africa to investigate the association between maternal CMD and infant illness. Perinatal CMD increased risk of infant diarrhoea, but not fever or ARI. More research is needed to identify mechanisms underlying the association, particularly examining the role of the mother–infant relationship. Meanwhile women’s health services and integrated management of childhood illness programmes should consider women’s mental health during the perinatal period and learn from recent successful intervention studies from LAMICs.

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**Competing interests** None.

**Ethics approval** This study was conducted with the approval of the Ethiopian Science and Technology Agency (National Research Ethics Committee) and King’s College London Research Ethics Committee.

**Provenance and peer review** Not commissioned; externally peer reviewed.

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