Title: Maternal Mental Health and Child Growth and Developmental Outcomes in Four Developing Countries

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Key words: maternal depression, growth stunting, underweight, cognitive development, psychosocial outcomes

Acknowledgements:

This work was funded by Grand Challenges Canada (Grant 0072-03 to the Grantee, The Trustees of the University of Pennsylvania).

Abstract:

Objective: To extend analyses of associations between maternal common mental disorders (CMD) with infant growth in low- and middle-income countries (LMICs) to children ages 5 and 8 as well as to broaden the analyses to include cognitive development, and psychosocial outcomes.
Design: Community based longitudinal cohort study in four LMICs (Ethiopia, India, Peru, and Vietnam). Surveys and anthropometric assessments were carried out in 2002, 2006-7, and 2009 when the children were approximately ages 1, 5 and 8. CMD was assessed with the SRQ-20 (≥8) in 2002. Growth was assessed at ages 1, 5, and 8, cognitive development was assessed with the PPVT at ages 5 and 8, while self esteem and life satisfaction were assessed at age 8.
Setting: A mixture of rural and urban as well as middle and poor income communities in each country
Participants: 7,269 mothers and their children with approximately 2,000 pairs from each country.
Results: A high rate of stunting and underweight was seen in the cohorts. After adjusting for potential confounders a significant association was found between maternal CMD and growth in India at all ages but not in the other countries. The adjusted odds ratios (aOR) for CMD and stunting in India were 1.65 (95% CI 1.68-2.14) at age 1 and 1.55 (95% CI 1.24-1.93) at age 8. For underweight the aOR were 1.24 (95% CI 0.99 - 1.55) at age 1, 1.39 (95% CI 1.14 - 1.69) at age 5, and 1.45 (95% CI 1.15 - 1.82) at age 8. India also showed a significant association between CMD and PPVT at age 8 (aOR 1.23; 95% CI 0.96 - 1.57). CMD was associated with low self esteem in 8 year olds from India (aOR 1.22; 95% CI 0.99 - 1.49), Peru (aOR 1.22; 95% CI 1.03 - 1.45), and Vietnam (aOR 1.35; 95% CI 1.00 - 1.84) while it was associated with low life satisfaction in Ethiopia (aOR 1.36; 95% CI 1.04 - 1.77) but not in the other cohorts.
Conclusions: Associations of maternal CMD with child outcomes varied across the study cohorts but were persistent across the first 8 years of life of the child and included growth, cognitive development and psychosocial domains.

Introduction:

Conditions in early childhood matter for child growth and development. In early childhood parents have strong influence on child outcomes. There is a substantial body of suggestive evidence that maternal mental health affects children in many domains, including nutritional status, health, cognitive and socio-emotional development.[1] In high-income countries these effects are primarily in the domains of psychosocial and emotional development while in some low-income countries associations with growth and illness are also seen.[2-6] Interventions to improve maternal depression have been associated in experimental designs with improved pediatric outcomes in both high- and low-income settings.[7,8] The magnitudes of associations of maternal common mental disorders such as depression with development and growth in middle-income countries, however, has not been well-described. In addition the assessment of these associations has primarily been over a very short time period – generally within the first 12 to 18 months of the life of the infant. These limitations in existing data make it difficult to inform interventions which may aim to address child outcomes in these vulnerable populations through maternal interventions. In this study we examine the associations between maternal mental health and child growth, cognitive development, and psychosocial wellbeing between infancy and age 8. We focus on four low- and middle-income countries (LMICs).[9]

Our study contributes to the existing literature in a number of important ways. First, the great majority of studies are based on samples from high-income countries. [1] Although sparse, the available evidence suggests that maternal depression prevalence rates in developing countries are unlikely to be lower than in developed countries. In fact, some of the risk factors for maternal depression (for instance, lack of support for women, and negative life events) are more prevalent in poorer settings and actual prevalence has been estimated to be higher in low-income countries. [10] Additionally, many of the studies available for developing countries are based on highly selected samples such as patients in health clinics or samples from restricted small geographical areas. Our study is based on a much more population-representative sample.

Secondly, overwhelmingly the focus in this literature is on the relatively brief immediate post-natal period and so called post natal depression (PND). This is motivated by the importance of the very first stages of childhood for long-term development. However, there is a dearth of evidence on the role that maternal mental health during infancy plays in later childhood. Our data offer the opportunity to examine effects of maternal mental health at three different key stages in childhood including infancy, age 5 years, and age 8 years.

Finally, the great majority of studies examine correlations between maternal health and child well-being (usually using cross-sectional data) without controlling for many of the likely confounders of this relationship. The design of the unique panel data-set utilised in this study offers a number of ways in which to address challenges in identifying the relationship between maternal mental health and child outcomes.

Methods:

The data used in this paper are from the Young Lives study, a multi-country longitudinal study of child poverty in developing countries that tracks approximately 2,000 children in each of four countries: Ethiopia, India (Andhra Pradesh), Peru and Vietnam.[11] In all four countries approximately one hundred children who

were aged 6-18 months in 2002 were randomly selected from each of 20 sites in each country (purposively selected to represent diversity within each country on key socio-economic, demographic and geographic dimensions with a pro-poor focus) to make a cohort of approximately 2,000 very young children per country (an older cohort also was selected but is not used in this paper). Detailed descriptions of data collection and interview methodologies have been previously published.[12-14] Briefly, adaptation of a common interview for each of the four countries was carried out through a pilot study focused on incorporating local idioms and expressions. Three rounds of data have been collected to date (in 2002, 2006-7 and 2009).

Study Measures:

The primary measures for the analysis in this paper include maternal mental health, child nutritional status, child cognitive development, and child psychosocial outcomes. Maternal mental health was measured using the Self-Reporting Questionnaire (SRQ-20), a screening tool developed by the World Health Organization (WHO) specifically for developing countries.[15] It consists of 20 yes/no statements relating to the mental well-being of the mother. An important feature of this measure is that while it is designed to cover both psychiatric disorders and mental distress, it is not diagnostic and cannot be used to distinguish between depression and anxiety/stress. Together, depression and anxiety are the most common of the mental health disorders and for this we accept the commonly used language “common mental disorder” (CMD) to describe a positive SRQ20 screen. This instrument has acceptable levels of reliability and validity in a range of developing countries. Cut off scores to determine how many yes-answers constitute a case have been validated against clinical assessments in each of the study countries.[16, 17] These validations indicated a score cut point of 7/8 to separate probable non-cases/cases of CMD.

The main outcomes of interest are child nutritional status, cognitive skills, and psychosocial outcomes. Nutritional status is captured using indicators of long-term growth (height for age z-scores) and body-mass-index (bmi z-scores). These are available for each of the three rounds of the survey.

Cognitive skill is assessed at ages 5 and 8 using the Peabody Picture Vocabulary Test, a widely-used test of receptive vocabulary (Spanish version PPVT-R).[18] Its main objective is to measure vocabulary acquisition in persons from 2.5 years old to adulthood. The test is individually administered, untimed, norm-referenced and orally delivered. The task of the test taker is to select the picture that best represents the meaning of a stimulus word presented orally by the examiner. Low cognitive skill is identified as having a score at or below the 20th percentile of (country-specific) scores for that cohort.

Psychosocial outcomes were carried out with assessments of self esteem and life satisfaction at age 8 years. Self esteem was conceptualized as pride and assessed through three Likert-type response scales in which children indicated their agreement with statements in terms of how much they agree with the statements: 1) “I am proud of my shoes or having shoes,” 2) “I feel my clothing is right for all occasions,” and 3) “I am proud of my clothes.” The main outcome measure used in this analysis is an index of the first factor from iterated principal components analysis of the responses to the Likert items.[19] The benefit of these indices is that they arrange the values for the children from lowest to highest scores which we then divided into quintiles. We used the lowest two quintiles of these indices as the risk category for all analyses.

Happiness, or satisfaction, is important to consider in poverty research because the poorest are not necessarily the least happy and there is growing recognition that people's own perceptions of their situation should be taken into account when seeking to develop or improve their living conditions.[20] The Life Satisfaction Ladder was included. Children were asked to indicate their position between their best- and worst- possible lives on a nine-point scale. Scoring in lowest quintile of scores is used to indicate the risk category.

Potential confounders were controlled for based on conceptual considerations and previous work with which we want to compare the current analyses. Child characteristics included age in months at each of the study assessment periods and gender (female). We included educational attainment as a maternal control variable because of the extensive linkage between education and both maternal mental health and child health status. A household wealth index based on the first principal component of household assets, housing quality and service access was used as a control for household resources.

Analyses:

The analytic approach taken in the current study is framed by a conceptual model linking maternal mental health with child outcomes (Figure 1). Descriptive analyses were carried out for all of the primary independent and dependent variables. Logit regression analyses were then carried out with SRQ-20 score of <8 versus ≥8 as the primary independent variable; child outcomes at each of the appropriate ages were regressed on elevated SRQ-20 score to create odds ratios (OR) for assessment of magnitude of association between the independent and dependent variables. We then regressed child outcomes on elevated SRQ-20 and the control variables to create adjusted ORs (aOR).

Results:

Table 1 presents the prevalence of probable cases of maternal CMD, child stunting, and underweight, cognitive development, psychosocial outcomes, and the distributions of the other variables included in the conceptual framework, for the four study populations.

The unadjusted and adjusted odds ratios for the association of maternal CMD with independent variables are shown in Table 2. The crude association of maternal CMD with growth measures is significant at age 1 of the cohorts for India, Peru and Vietnam; it was significant for stunting in India and Vietnam for underweight. After adjustment for confounding, the significant associations are retained for India in both stunting and underweight at all three ages. Vietnam has a significant aOR only for underweight and only at age 1. Unadjusted associations with low PPVT scores at age 5 and 8 are seen in both India and Peru though this association is retained only in India and only at age 8 with adjustment.

The psychosocial variables have an interesting pattern. An association between maternal CMD and low self esteem is seen even after adjustment for confounders in India, Peru, and Vietnam, while a significant association with low life satisfaction is seen only after adjustment in Ethiopia.

Conclusions:

The results of these analyses suggest that, while there is variation across countries, there are associations in LMICs between maternal mental health within the first 18 months of life of a child with child

growth and development that persist through 8 years of age. We found significant associations between maternal CMD in early childhood and probability of stunting and underweight in India, not just at the time of the assessment of mental health symptoms but persisting to ages 5 and 8. The association seen for this outcome in Vietnam, in contrast, does not persist past the first assessment at age 1. Our finding that risk of poor cognitive development – though not as strong as for anthropometric measures – is detected at age 8 after exposure to maternal CMD in infancy is very important for making linkages between mental health interventions and long-term outcomes for children in these LMICs.

The most robust and widespread associations with exposure to maternal CMD were for the self esteem assessment. This psychosocial measure is of great interest because of the potential for low self esteem to create obstacles to long term outcomes for children in poverty. There is increasing evidence that such measures are associated with educational and labor market outcomes over the life cycle.[21-25] The potential sensitivity of this outcome to exposure to early maternal CMD provide novel and significant new insights into possible processes and mechanisms by which maternal mental health can negatively influence child trajectories of wellbeing and lifetime success. Previous studies assessing negative impacts of maternal depression on children have focused on behavioural outcomes in younger children. In these studies an increased risk of psychopathology/behavioural abnormalities are seen in the children of women with major depression in the year postpartum – risk that is ameliorated with effective treatment of the mothers.[26, 27] The assessment of other aspects of psychological well being such as self esteem provide an opportunity to more fully understand the consequences of this exposure and potentially provide novel avenues for helping children with this exposure. Additional work is needed to confirm and extend these novel findings. Interventions to improve maternal mental health might consider adding these measures to assess benefits to children of such programs.

The heterogeneity in psychosocial outcomes is of significance as it is clear that a one size fits all approach to addressing these issues will not reflect the variability seen in national contexts. It is unclear what factors might result in the wide variation seen. Exploration of potential protective effects of national conditions is warranted.

There are a number of limitations to the current study. First, the Young Lives study is observational – and while it is longitudinal any associations identified are weak evidence for causality. However, studies of this type provide a necessary opportunity to explore a complex set of conditions and factors which can lead to significant insight into the economic, social, and psychological forces influencing children in poverty in LMICs. Second, there was a significant period of elapsed time between the measure of maternal CMD and the developmental and psychosocial outcomes. Only the anthropometric measures were available before age 5 years. However, we were able to detect persistent effects of maternal CMD on these critical domains of child well being indicating the magnitude that this effect has on children. Finally, the SRQ20 is a screening instrument and is not able to provide a clinical diagnosis of mental disorders. It is possible that more precise mental health measures would identify a greater magnitude of effect on child outcomes. Despite this we were able to see significant influences of elevated SRQ20 scores on outcomes. Despite these limitations, the study contributes to the literature by investigating the associations between CMD when children were infants and

child growth, cognitive development, and psychosocial wellbeing between infancy and age 8 in four low- and middle-income countries with very different contexts.

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Table 1. Description of study population.

	Ethiopia (n=1,757)	India (n=1,825)	Peru (n=1,850)	Vietnam (n=1,837)
Maternal Mental Health				
Probable CMD*	32	28	30	20
Child Growth				
Percent Stunted				
Age 1	41.7	31.0	28.2	20.3
Age 5	31.3	35.4	32.6	24.5
Age 8	21.0	29.1	20.1	19.4
Percent Underweight				
Age 1	31.4	32.5	6.6	14.3
Age 5	24.5	44.1	5.4	17.9
Age 8	35.4	45.8	5.7	24.9
Child Development				
PPVT Age 8 - Mean (SD)	67.9 (36.6)	49.0 (26.7)	47.0 (13.4)	77.3 (23.6)
Child Psychosocial – Age 8				
Self esteem scale primary factor Mean (SD)	-0.01 (1.48)	0.02 (1.39)	0.00 (1.28)	0.00 (1.41)
Life satisfaction scale (1-9) Mean (SD)	5.3 (2.0)	5.1 (2.3)	6.9 (2.1)	6.0 (2.2)
Child Characteristics				
Percent Female (Child)	46.6	46.3	49.8	48.8
Age in months (Age 1) - Mean (SD)	11.7 (11.6)	11.8 (3.4)	11.5 (3.5)	11.8 (3.1)
Age in months (Age 5) - Mean (SD)	61.9 (3.8)	64.2 (3.8)	63.5 (4.7)	63.1 (3.5)
Age in months (Age 8) - Mean (SD)	97.0 (3.7)	95.4 (3.9)	95.0 (3.6)	96.6 (3.4)
Maternal Characteristics				
Mother's education in years Mean (SD)	3.0 (3.9)	3.7 (4.4)	7.8 (4.4)	7.0 (4.0)
Household Characteristics				
Wealth Index - Mean (SD)	0.2 (0.2)	0.4 (0.2)	0.4 (0.2)	0.4 (0.2)

Table 2. Odds of poor growth, cognitive development, and psychosocial outcomes among children of women with probable CMD (SRQ20≥ 8) at child Age 1

	Ethiopia		India		Peru		Vietnam	
	OR [95% CI]	**aOR [95% CI]**	**OR [95% CI]**	**aOR [95% CI]**	**OR [95% CI]**	**aOR [95% CI]**	**OR [95% CI]**	**aOR [95% CI]**
Stunting								
Age 1	0.9 [0.71 - 1.13]	0.84 [0.67 - 1.06]	1.65*** [1.28 - 2.14]	1.34** [1.03 - 1.76]	1.39*** [1.12 - 1.72]	1.14 [0.89 - 1.46]	1.41* [0.98 - 2.02]	1.23 [0.89 - 1.70]
Age 5	0.96 [0.78 - 1.19]	0.92 [0.73 - 1.16]	1.39*** [1.12 - 1.72]	1.13 [0.90 - 1.43]	1.18 [0.94 - 1.47]	0.99 [0.77 - 1.27]	1.25 [0.91 - 1.72]	1.16 [0.89 - 1.53]
Age 8	1.01 [0.82 - 1.26]	0.98 [0.79 - 1.23]	1.55*** [1.24 - 1.93]	1.29** [1.02 - 1.63]	1.36** [1.07 - 1.73]	1.17 [0.93 - 1.49]	1.29 [0.92 - 1.79]	1.21 [0.91 - 1.62]
Underweight								
Age 1	1.07 [0.87 - 1.31]	1.06 [0.86 - 1.30]	1.47*** [1.17 - 1.85]	1.24* [0.99 - 1.55]	1.08 [0.72 - 1.61]	0.87 [0.57 - 1.35]	1.50*** [1.19 - 1.89]	1.36*** [1.10 - 1.69]
Age 5	0.99 [0.79 - 1.24]	0.94 [0.73 - 1.20]	1.62*** [1.34 - 1.96]	1.39*** [1.14 - 1.69]	1.24 [0.84 - 1.82]	1.02 [0.69 - 1.53]	1.33** [1.01 - 1.74]	1.22 [0.91 - 1.62]
Age 8	0.95 [0.78 - 1.17]	0.92 [0.72 - 1.16]	1.75*** [1.41 - 2.16]	1.45*** [1.15 - 1.82]	1.29 [0.93 - 1.80]	1.15 [0.81 - 1.62]	1.38** [1.01 - 1.87]	1.29 [0.95 - 1.74]
†PPVT Age 5	0.93 [0.71 - 1.21]	0.89 [0.69 - 1.14]	1.27** [1.02 - 1.59]	1.04 [0.82 - 1.32]	1.26** [1.02 - 1.57]	1.00 [0.76 - 1.32]	1.07 [0.76 - 1.52]	0.99 [0.72 - 1.36]
†PPVT Age 8	0.94 [0.70 - 1.28]	0.96 [0.70 - 1.31]	1.45*** [1.18 - 1.79]	1.23* [0.96 - 1.57]	1.20* [0.97 - 1.48]	0.98 [0.77 - 1.24]	1.12 [0.85 - 1.46]	1.09 [0.87 - 1.36]
††Self Esteem Age 8	0.99 [0.86 - 1.13]	0.97 [0.84 - 1.11]	1.41*** [1.16 - 1.73]	1.22* [0.99 - 1.49]	1.36*** [1.14 - 1.61]	1.22** [1.03 - 1.45]	1.39** [1.03 - 1.89]	1.35* [1.00 - 1.84]
†Life Satisfaction Age 8	1.34** [1.02 - 1.76]	1.36** [1.04 - 1.77]	1.31** [1.04 - 1.66]	1.12 [0.87 - 1.44]	1.21* [1.00 - 1.47]	1.09 [0.88 - 1.34]	1.2 [0.92 - 1.58]	1.14 [0.91 - 1.42]

*** p<0.01, ** p<0.05, * p<0.1.†Bottom 20th percentile, ††Bottom 40th percentile

OR – unadjusted estimates; aOR estimates adjusted for maternal schooling, sex of child, and age in months of child as well as wealth index when outcome measured

Figure 1 Conceptual framework