Common mental disorders among women, social circumstances and toddler growth in rural Vietnam: a population-based prospective study

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Abstract

Background   Common mental disorders (CMD) and adverse social circumstances are widespread among mothers of infants and toddlers in resource-constrained settings. These can undermine early childhood development through compromised caregiving and insufficient access to essential resources. The aim was to examine the effect of maternal CMD and social adversity in the post-partum year on toddler's length-for-age index in a rural low-income setting.

Methods   A population-based prospective cohort study of women in Ha Nam province, Vietnam who completed baseline assessments in either late pregnancy or 4–6 weeks post partum and were followed up, with their toddlers, 15 months later. CMD were assessed at both points by psychiatrist-administered Structured Clinical Interviews for Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition Diagnoses. Anthropometric indices were calculated from toddler's age, sex, weight and length using World Health Organization Child Growth Standards. Social adversities were assessed by study-specific questions and locally validated psychometric instruments. The hypothesized model of factors governing toddler's length-for-age Z score (LAZ) was tested using path analysis.

Results   In total, 211/234 (90.1%) mother–toddler pairs provided complete data. Baseline prevalence of CMD among women was 33.6% and follow-up was 18.5%. The mean LAZ among toddlers was −1.03 and stunting prevalence (LAZ < −2) was 15.6%. Maternal CMD at baseline were indirectly related to toddler LAZ via maternal CMD at follow-up (regression coefficient = −0.05, 95% CI −0.11 to −0.01). Maternal CMD at follow-up was associated significantly with toddler LAZ (regression coefficient = −0.15, 95% CI −0.28 to −0.05). Poorer quality of marital relationship, mothers' experiences of childhood abuse and <30 days dedicated post-partum care were associated indirectly with lower toddler LAZ via maternal CMD.

Conclusions   Maternal post-natal CMD are associated with child growth measured by LAZ in this resource-constrained setting. Social adversities affect child growth indirectly through increasing the risk of maternal CMD. Interventions to reduce stunting in low-income settings may need to address maternal CMD and social adversities in order to improve impact.

Introduction

There is increasing recognition that the common mental disorders (CMD) of depression and anxiety are a major public health problem among mothers of infants and toddlers in low-income settings (Fisher *et al.* 2012). Depression and anxiety are thought to have an adverse impact on parenting practices and caregiving, including through mothers with these mental health problems being less involved (Goldsmith *et al.* 1997), sensitive or responsive (Murray *et al.* 1996; Cooper *et al.* 1999; Baker-Henningham *et al.* 2003; Black *et al.* 2009), and more hostile when interacting with their children (Breznitz & Friedman 1988; Lovejoy *et al.* 2000), and, thereby undermining early childhood development. There is evidence from low- and middle-income countries (LMIC) of negative associations between maternal CMD and early childhood cognitive (Patel *et al.* 2003; Tran *et al.* 2013a), motor (Hadley *et al.* 2008; Nasreen *et al.* 2013; Tran *et al.* 2014b), and social and emotional development (Hadley *et al.* 2008; Tran *et al.* 2014a).

Early childhood growth, as measured by the height-for-age index, is a key early childhood outcome because it is an established proxy indicator for health and nutritional status and is associated with lower adult stature, increased risk of health problems in adulthood and reduced lifetime economic productivity (Black *et al.* 2008; Adair *et al.* 2013; Hoddinott *et al.* 2013). There are a number of studies examining the association between maternal CMD and early childhood growth in LMIC. Surkan and colleagues' (2011) recent review demonstrated that among 12 studies (1996–2010) in LMIC, five reported an association between maternal depression and increased likelihood of stunting (the lowest extreme of child growth defined as height-for-age below −2 standard deviations from the median of the reference population) among children and seven did not find a significant association. Meta-analysis of data from these 12 studies found a significant association between maternal depression and child stunting [pooled odds ratio (POR) = 1.4, 95% confidence interval (CI): 1.2–1.7] and when restricted to the four prospective studies the pooled estimate for the association became stronger, but not significant (POR = 2.0, 95% CI: 1.0–3.9). However, recent prospective studies in Bangladesh, South Africa and Ethiopia found maternal post-partum depressive symptoms were not associated with stunting among infants (Tomlinson *et al.* 2006; Medhin *et al.* 2010; Nasreen *et al.* 2013).

There are several limitations in the existing studies, which might elucidate these diverse findings. First, they only assessed maternal depression and none of them investigated anxiety. Although anxiety and depression have symptoms in common, frequently co-occur and are often not distinct, assessing only for depression underestimates the prevalence of disabling symptoms of psychological morbidity. Both psychological states can interfere with caregiving. Anxiety among mothers is associated with poorer early childhood outcomes including cognitive, motor and social-emotional development (Van den Bergh *et al.* 2005; Keim *et al.* 2011). Second, only 4 of the 14 available studies had a prospective longitudinal design, which is the most robust method of investigating whether there is a causal relationship between an exposure and an outcome. The others used a cross-sectional design, which only permits associations, but not causal relationships to be detected. Third, most studies did not use a diagnostic test to establish the nature and prevalence of CMDs among women. Instead, they used self-report screening questionnaires (Baker-Henningham *et al.* 2003; Patel *et al.* 2003; Harpham *et al.* 2005; Black *et al.* 2009; Avan *et al.* 2010; Santos *et al.* 2010; Nasreen *et al.* 2013) some not locally validated (Baker-Henningham *et al.* 2003; Patel *et al.* 2003; Black *et al.* 2009; Avan *et al.* 2010; Santos *et al.* 2010) to ascertain symptoms of depression among women. Fourth, in most studies, stunting was classified as a binary and not as a continuous scale, as the indicator of early childhood growth and they did not describe a potential mechanism for the relationship between maternal CMD and early childhood growth. The adverse effects of maternal depression and anxiety on early childhood growth may be through interfering with sensitive-responsive parenting practices and the effects should be observable among all infants whose mothers have CMD rather than only among stunted infants. Therefore, a continuous scale of early childhood growth should be used to confirm the effect of maternal mental health problems on this outcome. The aim of this study was to examine the effect of maternal CMD including both depression and anxiety and social adversity in the first post-partum year on toddler's length-for-age index at 15 months of age.

Methods

Study design

This was a population-based prospective study, which recruited a cohort of women who were in the last trimester of pregnancy or had recently given birth and followed them up, with their toddlers, 15 months post partum. Data were collected in two surveys: the baseline survey (S1) when the women were recruited and the follow-up survey (S2) when their children were aged approximately 15 months. The baseline survey was conducted in the urban city Hanoi and the rural province Ha Nam. The design and results of the baseline survey have been reported elsewhere (Fisher *et al.* 2010; Tran *et al.* 2011). In brief,

the prevalence of CMD was the same among women who were in advanced pregnancy and women who had recently given birth. Only participants in Ha Nam were followed up and included in this study.

Setting

Ha Nam Province is located approximately 50 km south of Hanoi, the nation's capital city. It has a population of 0.8 million people and an average annual per capita income of approximately USD850 in 2013 compared with the national figure of USD1911 and USD3134 in Hanoi (GSO 2013). Almost all pregnant women (99%) have at least one antenatal healthcare visit and give birth at a provincial, district or commune health facility and 99.8% of children aged under 5 years are fully immunized. In 2013, the under-five mortality rate was 5.3 per 1000 live births compared with the corresponding national rate of 16 per 1000 live births. Mental health is not considered either in antenatal care or in primary post-natal health care in Vietnam.

Participants and recruitment

Participants in this study were recruited through a multistage sampling procedure that included (1) selecting study communes; (2) inviting all eligible women to participate in this study. An independent statistician selected six of a total 116 communes in Ha Nam randomly using the 'select' command in Stata 9 (StataCorp LP, College Station, TX, USA). A commune, having a population of 5000–10 000 residents, is the primary local government administrative unit in Vietnam and each has a commune health centre. Inclusion criteria were (1) living in the selected communes; (2) being at least 32 weeks pregnant with a single foetus or being the mother of a singleton 4- to 6-week-old infant; (3) being registered with the commune health station as pregnant or having recently given birth; and (4) being able to provide informed consent to participate. It was estimated that there were approximately 35–45 eligible women in each commune during the recruitment period. All women who met the inclusion criteria were informed of the study either during home visits associated with the Expanded Programme of Immunization or by announcements on the village loudspeaker system and invited to participate.

Data sources

Data were collected by diagnostic interviews, locally validated standardized psychometric measures, study-specific structured questions and anthropometric measurements of children.

CMDs were assessed at S1 and S2 by psychiatrist-administered Structured Clinical Interviews for the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition Axis 1 Diagnoses (SCID-I) modules for depression, generalized anxiety and panic disorder (First *et al*. 1996). This is the demonstrated gold standard for diagnosis of perinatal mood disorders in diverse cultural settings and countries (Gorman *et al*. 2004).

Quality of intimate partner relationship was evaluated at S1 and S2 by the 24-item Intimate Bonds Measure – Vietnam validation (Wilhelm & Parker 1988; Fisher *et al*. 2014), which yields two subscales, 'Care' and 'Control'. The Care subscale assesses perceived sensitivity, warmth, emotional responsiveness, trust, physical gentleness and capacity for companionship. The Control subscale assesses perceived coerciveness, exertion of power or dominance and extent of criticism. Both subscales are scored from 0 to 36, but with higher scores on the Care subscale indicating more optimal and on the Control subscale less optimal quality of relationship. The Vietnamese validation of the Intimate Bonds Measure (IBM – V) demonstrated that it was meaningful and comprehensible to Vietnamese women and sensitive to relevant aspects of the relationships with their intimate partners (Fisher *et al*. 2014). It has an identical factor structure to the original measure.

The quality of the woman's relationship with her own mother and mother-in-law was ascertained at S1 by single study-specific fixed-choice questions assessing trust and affection in these relationships.

Duration of post-partum period of heightened care from others before resuming usual activities was collected by study-specific questions at S2.

Women's experiences of childhood abuse were assessed by study-specific questions at S1, sexual abuse as any unwanted sexual encounter with an adult and physical abuse as being beaten or otherwise physically maltreated by a parent or other person in authority before the age of 16 years.

Feeding practices and child characteristics and health were collected at S2 including birthweight, breastfeeding (duration and if the mother perceived that her breast milk supply was sufficient for the child's needs), the age at which complementary foods were introduced and if the child had ever been hospitalized for treatment of a health problem.

Sociodemographic variables were collected by study-specific questions at S1 and included age and marital, educational and occupational status. Household wealth was assessed by the World Bank household wealth index method (Tran 2004), which is calculated from information about 17 household characteristics, services and durable assets.

Child anthropometry

Child weight was measured by the Seca 876 Scale (Seca, Ltd, West Midlands, UK) that first measures maternal weight and second measures the weight of the child when held in her arms. Child length was measured with a portable Shorr board (Shorr Productions LLC, Olney, MD, USA). Child's age and sex were derived from the birth certificate. In Ha Nam, 100% of births are registered. *Anthropometrical indices* at S2, including length-for-age, weight-for-age and weight-for-length *Z* scores of the World Health Organization (WHO) Child Growth Standards, were calculated from child's age, sex, weight and length by WHO Anthro version 3.2.2 (World Health Organization 2012). The WHO Child Growth Standards recommended for international use were developed from data provided by 8440 healthy young children from widely diverse ethnic backgrounds and cultural settings including Brazil, Ghana, India, Norway, Oman and USA to replace the NCHS (National Centre for Health Statistics)/WHO growth reference that had been widely used since the late 1970s (World Health Organization 2006).

Procedure

As completion of self-report questionnaires is unfamiliar, data were collected by face-to-face individual interviews and recorded on paper forms, which is the method women in this area, many of whom have low literacy, prefer (Fisher *et al.* 2010). Women were interviewed in private rooms at commune health centres by a member of the trained interviewer team of the Research and Training Centre for Community Development (RTCCD). Anthropometric assessment of children was undertaken in the commune health station by trained health research assistants of RTCCD. A senior Vietnamese psychiatrist from RTCCD, Doctor La Thi Buoi, administered the SCIDs in separate individual interviews at both S1 and S2. S1 was carried out in November and December 2006 and S2 in January and February 2008.

Data analyses

Data management and basic data analyses were performed in STATA version 12 (StataCorp LP, College Station, TX, USA).

Path analysis was performed in Mplus version 6 (Muthén & Muthén, Los Angeles, CA, USA) to test the hypothesized model presented in Fig. 1 that maternal CMD at baseline is directly associated with lower child length-for-age *Z* score (LAZ) and indirectly associated with the outcome via increasing risk of
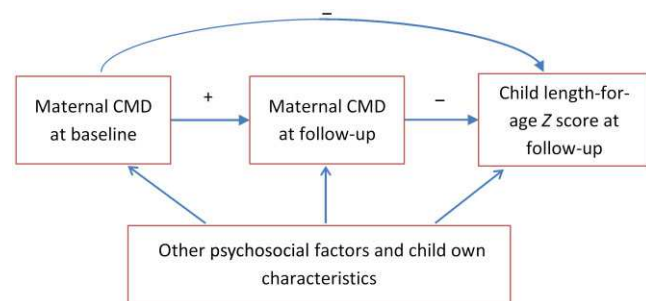

Figure 1. Hypothesized model of the effect of maternal common mental disorders (CMD) at baseline and follow-up on child length-for-age *Z* score.

maternal CMD at follow-up that is adversely associated with the child outcome. Potential confounders were added into the model based on the evidence of previous studies in Vietnam (Fisher *et al.* 2010, 2013) and other LMIC (Lund *et al.* 2010; Fisher *et al.* 2012; Howard *et al.* 2013).

The model was estimated using weighted least squares and the probit link function that are recommended for models combining binary and continuous outcomes. For continuous outcomes (i.e. toddler LAZ), the analyses produced linear regression coefficients, which can be interpreted as a relationship in which one unit increase in the predictor increases a coefficient unit in the outcome if the other predictors are kept constant. For binary variables (e.g. maternal CMD), probit regression coefficients were produced. Probit regression coefficients represent the changes in probit index for unit changes in the predictors. For ease of explanation, the probit coefficients were converted to equivalent odds ratios (Long 1997). All of the variables were retained in the model even if non-significant. In order to evaluate model fit, we used the chi-square test of model fit with *P* values greater than 0.05 indicating a good fit, root mean square error of approximation (RMSEA) with values less than 0.05 indicating a good fit, and Tucker–Lewis index (TLI) and comparative fit index (CFI) with values greater than 0.95 indicating a good fit (Kline 2011). The final number of participants included in the analyses was 211. It is estimated that about 10 participants are needed for a variable to be included in a multivariable analysis.

Ethics approval

Approvals to conduct the study were provided by the Vietnam Medical Association's Ethics and Scientific Committee and the University of Melbourne's Health Sciences Human Ethics Committee (HREC No. 050793). There are no local services for the

Table 1. Sociodemographic characteristics, reproductive health, intimate relationships and mental health status of 211 women

Variable	Values
Stage when recruited for baseline survey, n (%)	
>32 weeks pregnant	124 (58.8)
4 to 6 weeks post partum	87 (41.2)
Age in years, mean (SD)	25.6 (5.1)
Completed education, no. (%)	
Up to complete primary (years 1–5)	82 (35.0)
Complete secondary (years 6–9)	118 (50.4)
Complete high school (years 10–12)	19 (8.1)
Post-secondary	15 (6.4)
Occupation, n (%)	
Agricultural, factory or handcraft worker	191 (90.5)
Government officer	9 (4.3)
Housewife, unemployed	11 (5.2)
Primiparous, n (%)	87 (39.4)
Intimate bonds measure – care scores, mean (SD)	
Baseline	32.3 (4.3)
Follow-up	30.3 (5.8)
Intimate bonds measure – control scores, mean (SD)	
Baseline	11.9 (6.9)
Follow-up	12.0 (6.7)
Any common mental disorder, n (%)	
Baseline	71 (33.6)
Follow-up	39 (18.5)

Table 2. Anthropometric indices of 211 toddlers at 15 months of age

Anthropometric index	Values
Length-for-age Z score	
Mean (SD)	−1.03 (0.90)
<−2, n (%)	33 (15.6)
Weight-for-age Z score	
Mean (SD)	−1.27 (1.03)
<−2, n (%)	53 (25.1)
Weight-for-length Z score	
Mean (SD)	−0.17 (0.96)
<−2, n (%)	3 (1.4)

Figure 2. Distributions of anthropometric indices in 211 toddlers.

treatment of CMD in Ha Nam so participants who were diagnosed with a mental disorder were referred to the RTCCD TuNa Clinic or Mai Huong Psychiatric Hospital for the care of people with common and severe mental disorders, both located in Hanoi.
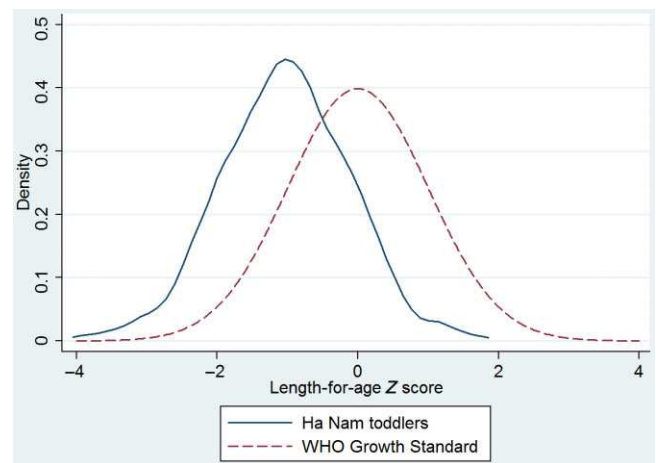
Results

Sample

Overall, 234 of 255 eligible women (91.8%) agreed to participate and provided data at S1. Of these, 211 women (90.1%) and their children provided complete data in the follow-up survey and were included in analyses. There were no significant differences in the socio-demographic and psychological characteristics at baseline between women who provided complete or partial data.

The characteristics of the 211 women are presented in Table 1 and were similar to those of other studies of perinatal health among women in rural Vietnam (Tran *et al.* 2011; Hanieh *et al.* 2013). The IBM-V Care subscale and Control subscale mean scores changed slightly, but not significantly between baseline and follow-up. The prevalence of CMD in the cohort declined significantly between the two time points from about a third of participants to less than a fifth (Nguyen *et al.* 2015). There were

no differences in CMD prevalence between the groups assessed in advanced pregnancy or the early post-partum period at baseline or follow-up (Fisher *et al.* 2010).

The mean scores of the three anthropometric indices among the 15-month-old toddlers of the 211 women are shown in Table 2 and the distribution of LAZ are presented in Fig. 2. The mean score of length-for-age index in this study was 1.03 standard deviations lower than the WHO child growth standard, mean score of weight-for-age was 1.27 standard deviations below the WHO child growth standard, and mean score of weight-for-length was 0.17 standard deviations below the WHO child growth standards. The prevalence of LAZ < −2 (stunting) was 15.6%, WAZ < −2 (underweight) 25.1%, and WLZ < −2 (wasting) 1.4% in the study children.

Path analysis of child length-for-age Z scores

The path model included 21 variables to explain the variance of child LAZ at 15 months of age. All of the fit indices are within the range indicating that the model fits the data well (chi-square
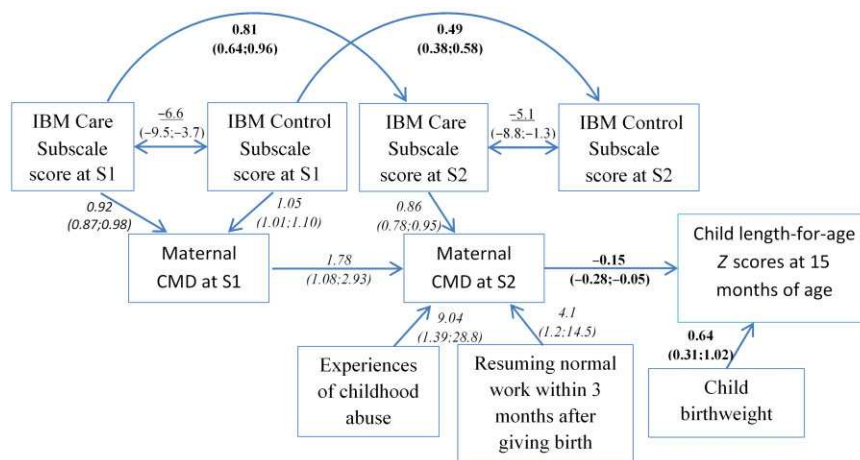
Figure 3. Path model predicting child length-for-age *Z* scores at 15 months of age. Only significant paths (*P* < 0.05) were included. Single-headed solid arrows represent statistically significant directional paths (coefficients in *italics* are odds ratios and 95% confidence interval (CI); coefficients in bold are linear regression coefficients and 95% CI). The double-headed arrow indicates the variables that are assumed to be correlated. IBM, Intimate Bonds Measure; CMD, common mental disorders; S1, baseline survey; S2, follow-up survey.

test of model fit with *P* value = 0.67, RMSEA < 0.001, TLI = 1.06 and CFI = 1.00). The statistically significant paths are presented by a graphic model in Fig. 3.

Maternal CMD at baseline is indirectly related to toddler LAZ via maternal CMD at follow-up (regression coefficient = −0.05, 95% CI −0.11 to −0.01). The direct pathway from maternal CMD at baseline to the toddler outcome was not significant. Higher IBM Care subscale scores were significantly associated with a lower risk of maternal CMD at both baseline and follow-up. Higher IBM Control subscale scores, experiences of childhood abuse, and a shorter time of dedicated heightened post-partum care were related to a higher risk of maternal CMD at baseline or follow-up. Therefore, IBM Care and Control subscales scores, experiences of childhood abuse, and less time resting after giving birth were indirectly associated with toddler LAZ via maternal mental health status. Socio-demographic characteristics, child characteristics and health, and the duration of breastfeeding were included in the analysis, but were not associated with the outcome.

A similar path analysis was performed in which toddler stunting was used as the primary outcome instead of toddler LAZ. Like the results of the first model, maternal CMD at baseline was associated with a higher risk of maternal CMD at follow-up and, in turn, maternal CMD at follow-up was associated with an increasing risk of stunting in children (OR = 1.65, 95% CI: 1.10–2.49).

Discussion

This study examined the association between maternal postnatal CMD and child growth at 15 months of age, taking relevant psychological and social factors into account. This is one of very few studies to date worldwide to use a gold-standard psychiatrist-administered tool to diagnose CMDs including depression and anxiety among women prospectively in the first year after giving birth in a rural setting in a LMIC. Toddler growth was assessed by length-for-age *Z* score following WHO standardized techniques. The path analyses used in this study allow sophisticated models of both direct and indirect relationships among a number of variables to be tested.

In this study the distribution of LAZ was lower than the reference distribution through the whole range of values (Fig. 2). The Vietnam national survey on nutrition in 2010 (MOH *et al.* 2010) found that mean LAZ in children aged 12–17 months was −0.57 [standard deviation (SD = 1.77)] and prevalence of stunting was 28.8%. Our sample had a lower mean LAZ (−1.03) and a lower proportion of stunting (15.6%), attributable to the fact that the national data have a wider distribution (SD = 1.77) than the one we report (SD = 0.9). A cross-sectional study (Nakamori *et al.* 2010) of 188 1-year-old children in Bac Giang, another rural province in the north of Vietnam, found that mean LAZ was −1.21 (SD 1.19) and stunting prevalence of 14.4%. Our findings confirm (MOH *et al.* 2010; Nakamori *et al.* 2010) that undernutrition is prevalent among toddlers in rural Vietnam.

Our data therefore confirm the association between maternal CMD and an increased risk of toddler stunting and extend it by the finding of an association between maternal CMD and toddler growth, measured by LAZ at 15 months of age. In the absence of explanatory models for this association, our interpretation of these data are somewhat speculative. First, it is possible, as others have suggested, that the link is via compromised caregiving. Mothers with depression and/or anxiety are less likely to be attuned to infant cues and responsive to their baby's needs (Goldsmith *et al.* 1997) (Fleming *et al.* 1988; Field *et al.* 1990; Murray *et al.* 1996; Cooper *et al.* 1999;

Baker-Henningham *et al.* 2003; Black *et al.* 2009). This might be reflected in poor recognition of infant hunger and satiety, or worse food preparation practices which might lead to increased risk of infant diarrhoeal diseases, or lack of playful interactions with the baby that include supported weight bearing. Women with low mood are more likely to be irritable with and hostile towards their babies (Breznitz & Friedman 1988; Murray *et al.* 1996; Lovejoy *et al.* 2000) and in this circumstance might neglect care-seeking behaviours from the baby including attempts to suckle or seek food when hungry. It was not exposure to maternal CMD in late pregnancy or early in the post-partum period that was linked to restricted growth, but rather that the risk of CMD 15 months post partum was increased among women who had experienced perinatal CMD. While CMD might have followed a relapsing and remitting course, it is possible that women who had CMD at both assessments had sustained low mood throughout their toddlers' infancy and that it was chronicity of maternal CMD that was associated with worse infant and toddler growth.

These data are however among the first to demonstrate that CMD among women caring for toddlers are an indicator of multiple exposures to adversity, including: interpersonal violence in her own childhood, a relationship with the intimate partner that is characterized by coercion, control and a lack of affection and kindness, and lack of dedicated care during the first 30 post-partum days, all occurring in the context of poverty. It is therefore essential to consider that these factors constitute risks both to maternal mental health and to poor child growth. We have shown that pregnant women with CMD [risks for which are household poverty, intimate partner violence and hostility from members of the in-law family (Fisher *et al.* 2010)] are less likely than others to use recommended nutritional supplements (Fisher *et al.* 2011; Tran *et al.* 2013b). This is probably because in households in which they feel intimidated or have a low sense of entitlement to influence decisions about household expenditure, they are not able to purchase them. It is plausible that this situation is also relevant to early childhood development. If women do not feel able to influence household-purchasing decisions, including about food, it is possible that that there is insufficient food available to meet the toddler's daily or growth needs and probably also the mother's. Men's behaviours are central to women's emotional well-being. If they behave with respect, consideration, encouragement and kindness towards their partners, then well-being is protected and promoted. In contrast, risk of CMD is increased among women who experience their partners as coercive, intimidating and controlling. These data suggest that these behaviours are also relevant to child growth, by contributing to

low mood and compromised caregiving among women. The traditional custom in Vietnam is for women to have at least 30 days of heightened care from other women and social seclusion following childbirth. Women in rural areas who do not have this traditional care are in general less well supported and resourced (Lundberg & Trieu 2011). These data indicate that women in the predicament of being devalued and poorly cared for by their partners and other family members are then less able to provide adequate care for their young children.

In 2012, the WHO set a global target to reduce by 40% the number of stunted children under 5 years of age by 2025 (World Health Organization 2012). Current efforts aim to improve early childhood growth in resource-constrained settings by providing information and promoting positive breastfeeding, complementary feeding, hygiene and sanitation practices, and management of common childhood illness (Bhutta *et al.* 2008; de Onis *et al.* 2013). This study suggests that a more comprehensive approach, which takes women's own needs for support and care into account, is more likely to be effective. Maternal mental health should therefore be considered by policy makers and public health professionals who are working to improve child nutrition status. Addressing post-natal CMD in women could by itself positively affect child outcomes. However, an integrated intervention that combines strategies to address maternal mental health and child nutrition, health and development is likely to increase impact (Rahman *et al.* 2013). When women's mental health is improved, they are more likely to be involved, sensitive, and responsive and to be more able to acquire and implement new knowledge about child nutrition and illness. There are likely to be further benefits in that women who have more knowledge about effective caregiving, can feel more confident and less anxious, thereby reducing maternal CMD. This study demonstrates that a woman's relationship with her intimate partner, especially his capacity to provide affection, affirmation and encouragement, can indirectly affect child growth via its influence on her mental health. These data indicate therefore that future interventions should include women's partners and raise the awareness of other family members about what a women needs if she is to care well for a young child.

We acknowledge that the sample was located in a rural province and the findings might not be generalizable to children living in better-resourced urban settings. Ha Nam Province is not as disadvantaged as some more remote rural provinces where it is possible that the prevalence of these health and development problems is higher. Another limitation was that we only assessed outcomes at two time points and therefore cannot ascertain the course of maternal CMD or infant growth during

the post-partum year because we lack data about potential mediators including caregiving practices and common infant illnesses such as diarrhoeal or acute respiratory infections. Finally, a relative small sample size could make the study potentially underpowered to detect small-effect size relationships.

Despite these limitations we believe that these high-quality data are of value in elucidating relationships among maternal health and circumstances and early childhood development in the context of poverty. Restricted growth including stunting and underweight is prevalent among rural Vietnamese children. Maternal post-natal CMD, in particular sustained CMD is associated with restricted toddler growth at 15 months of age measured by LAZ. The precise mechanisms for this association are yet to be clarified, but these data suggest that social disadvantages affect toddler growth indirectly through increasing the risk of maternal CMD and reducing the quality of caregiving. Future research should focus on examining the mechanisms of the association between maternal post-natal CMD and child growth as well as the effect of interventions addressing maternal CMD on child growth in LMIC.

Key messages

- CMDs are prevalent among women who are pregnant or have recently given birth in low- and middle-income settings;
- Stunting is common among children in the first years of life in low- and middle-income settings.
- Maternal CMDs are related to diminished early childhood growth;
- Poor quality of marital relationship, experiences of childhood abuse and less than 30 days of dedicated post-partum care adversely affect early childhood growth via increasing the risk of maternal mental disorders;
- The mechanisms whereby maternal mental disorders restrict early childhood growth in resource-constrained settings require further investigation.

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