Original Article

Psychological distress in mothers of children admitted to a nutritional rehabilitation unit in Malawi – a comparison with other paediatric wards

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Abstract

In a previous study we found a very high prevalence of psychological distress in mothers of children admitted to a nutritional rehabilitation unit (NRU) in Malawi, Africa. The objective of this study was to compare the prevalence and severity of maternal distress within the NRU with that in other paediatric wards. Given the known association between poor maternal psychological well-being and child undernutrition in low- and middle-income countries, we hypothesised that distress would be higher among NRU mothers. Mothers of consecutive paediatric inpatients in a NRU, a high-dependency (and research) unit and an oncology ward were assessed for psychological distress using the Self-Reporting Questionnaire (SRQ). Two hundred sixty-eight mothers were interviewed (90.3% of eligible). The prevalence of SRQ score ≥ 8 was 35/150 [23.3% [95% confidence interval (CI) 16.8–30.9%]] on the NRU, 13/84 [15.5% (95% CI 8.5–25.0%)] on the high-dependency unit and 7/34 [20.6% (95% CI 8.7–37.9%)] on the oncology ward ($\chi^2 = 2.04$, $P = 0.36$). In linear regression analysis, the correlates of higher SRQ score were child diarrhoea on admission, child diagnosed with tuberculosis, and maternal experience of abuse by partner; child height-for-age z -score fell only just outside significance ($P = 0.05$). In summary, we found no evidence of greater maternal distress among the mothers of severely malnourished children within the NRU compared with mothers of paediatric inpatients with other severe illnesses. However, in support of previous research findings, we found some evidence that poor maternal psychological well-being is associated with child stunting and diarrhoea.

Keywords: maternal mental health, depression, malnutrition, child growth, low income countries.

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Introduction

There is considerable evidence that child undernutrition is associated with poor maternal mental health in low- and middle-income countries (LMIC). A recent meta-analysis calculated a pooled odds ratio for having a mother with depression and/or anxiety of 1.4 for stunting and 1.5 for underweight (Surkan *et al.* 2011). This relationship may be bidirectional. A sick or severely undernourished child is a

risk factor for maternal distress and depression and there are shared risk factors for both maternal distress/depression and childhood undernutrition including poverty and food insecurity (Stewart 2007). There is also evidence from prospective studies that poor maternal psychological well-being is an independent risk factor for childhood undernutrition (Patel 2003; Rahman *et al.* 2004a; Adewuya *et al.* 2008), although prospective studies from Ethiopia and South Africa did not replicate these findings

(Tomlinson *et al.* 2006; Medhin *et al.* 2010). It has been suggested that typical depressive symptoms such as reduced concentration, fatigue and lack of interest in daily activities may alter mother–child interaction and impair behaviours such as persistence with feeding, maintenance of hygiene and accessing of general health care services (Stewart 2007). Maternal depression has also been associated with earlier cessation of breastfeeding (Patel 2003; Adewuya *et al.* 2008), incomplete immunisation (Rahman *et al.* 2004a) and greater frequency of diarrhoeal episodes (Rahman *et al.* 2007; Adewuya *et al.* 2008).

Most of the research into maternal mental health and child undernutrition in LMIC has been conducted in clinic or community settings. There has been minimal investigation of the mental health of mothers of children admitted to nutritional rehabilitation units (NRU) for treatment of acute severe malnutrition.

In the only study of psychological well-being among mothers of children admitted to a NRU in sub-Saharan Africa, we found that 70.9% of mothers of children admitted to a tertiary hospital NRU for treatment of acute severe malnutrition in Malawi had marked distress, identified using a locally validated version of the Self-Reporting Questionnaire (SRQ; Stewart *et al.* 2011).

In that study, the prevalence of marked distress (SRQ ≥ 8) fell to 33.5% at 4-week post discharge assessment. This was similar to a prevalence of 29.9% found among mothers attending an outpatient child health clinic in rural Malawi (Stewart *et al.* 2009). The fall in distress levels between admission and follow-up suggests that the acute stress of the admission of a very sick child was a key factor in the high SRQ scores. However, in addition to acute distress,

the high SRQ scores may reflect more longstanding poor psychological well-being among mothers of children who present with acute severe malnutrition.

In the earlier study of maternal distress on a NRU, no comparison was made with mothers of children admitted with severe illnesses to other wards. If a relationship between maternal psychological state and child acute severe malnutrition does exist, one would expect to find higher levels of distress among mothers of children admitted to a NRU than among mothers of children admitted to other wards with illnesses of similar severity. On the other hand, if a high level of distress simply reflects the acute stress of the admission of a very sick child then there would be no difference between mothers of children admitted to a NRU and those of very sick children admitted to other paediatric units.

The primary aim of this study was to investigate the hypothesis that psychological distress would be significantly higher in mothers of children with severe acute malnutrition admitted to a NRU, compared with mothers of other very ill, hospitalised children. Our secondary aim was to identify risk factors associated with maternal distress across a range of paediatric inpatient settings.

Materials and method

The setting for this study was the Moyo House NRU, the paediatric high dependency (and research) unit (HDU) and the paediatric oncology ward (ONC) of Queen Elizabeth Central Hospital (QECH), Blantyre, Malawi. QECH is the largest public hospital in Malawi with a catchment area including the city of Blantyre and the surrounding rural districts.

Key messages

- Mothers of children admitted to a nutritional rehabilitation unit with severe acute malnutrition in Malawi have been shown to experience very high levels of distress.
- This study found that distress reported by mothers of children admitted to a nutritional rehabilitation unit was not greater than that of mothers of children admitted to other wards.
- Factors associated with distress in mothers of paediatric inpatients include child diarrhoea and maternal experience of abuse by partner.
- Further prospective studies are needed to clarify the association between maternal mental health and child nutrition in sub-Saharan Africa.

The comparison wards were selected as they admit children with other severe acute and chronic illnesses. Mothers of consecutive paediatric inpatients were recruited during a 7-week period in February and March 2012. Criteria for admission to the NRU were $\leq 70\%$ of the median child weight-for-length for their age-group with reference to the World Health Organization (WHO) growth data (1978), mid-upper arm circumference (MUAC) of less than 11 cm (for those aged 12–59 months) or bipedal nutritional oedema. Children admitted to the HDU were those who required intensive clinical and nursing care, usually because of acute neurological or infectious illness such as severe or cerebral malaria, meningitis or uncontrolled epilepsy. Children admitted to ONC were those being treated or investigated for cancer. On each of these wards, all children were accompanied by ‘guardians’ – usually their mothers – throughout their stay.

In the NRU, each child began Phase I milk-based therapeutic feeding immediately after admission. The duration of Phase I feeding varied depending on the child’s health status. Following stabilisation of the child’s health, the child was commenced on Transition Phase feeding, which involved the introduction of peanut-based ready-to-use therapeutic food. Children were often discharged to the Outpatient Therapeutic Programme before reaching Phase II feeds, when phala (porridge) was introduced to the diet. In this study, mothers were recruited from the NRU when the child had commenced Transition feeding. On the HDU and ONC mothers were recruited 3 and 5 days post-admission, respectively. These time points were selected to lessen coincidence with the periods in which the risk of inpatient death was highest and to minimise any distress associated with participation. Only mothers who were accompanying their own child were included in the study; all other guardians were excluded. Mothers who were unable to communicate effectively in Chichewa (the most widely spoken and official language of Malawi), or who had any severe pre-existing mental or physical disability, were also excluded.

Eligible mothers who gave informed consent underwent interviews with an experienced local nurse-interviewer (TN). TN also measured the maternal

MUAC to the nearest 0.1 cm using UNICEF insertion tapes. Data were collected from the child inpatient notes by the lead author (SC). Child anthropometry was performed by other experienced nursing staff as part of the admission process on each ward.

Maternal distress

The WHO-designed SRQ was used as the measure of distress. The questionnaire was translated into Chichewa and validated in a previous study (Stewart *et al.* 2009). The SRQ is designed for use by health-workers or researchers with limited training, particularly in developing countries (WHO 1994) and has been used in several previous studies exploring the relationship between maternal psychological well-being and infant health (Rahman *et al.* 2004b; Harpham 2005; Stewart *et al.* 2008). The SRQ consists of 20 questions enquiring about symptoms of depression, anxiety and somatic manifestations of distress occurring over the preceding 4 weeks. The total number of affirmative answers provides each participant with a SRQ score between 0 and 20.

The SRQ may be used as both a categorical or continuous measure. Categorisation of participants into ‘distressed’ or ‘not distressed’ groups may have greater clinical utility, but leads to a loss of statistical information (Altman & Royston 2006). A cut-off score of 8 or above provided optimal sensitivity and specificity for detection of Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition major depression among mothers of infants attending an outpatient child health clinic in rural Malawi (Stewart *et al.* 2009), and was used in the previous study of maternal distress in the NRU (Stewart *et al.* 2011). Dichotomised SRQ scores were used to allow comparison with previous studies, and the total SRQ scores were used as the dependent variable when investigating the association between distress and possible risk factors.

Child factors

1. Ward.
2. Age and sex.

3. Admission weight and length. These were converted into weight-for-age, length-for-age and weight-for-height *z*-scores based on WHO-standardized growth data (1978), using Epi-Info.
4. Primary diagnosis.
5. HIV status and when tested.
6. Diarrhoea on admission (maternal report).
7. Diagnosed tuberculosis.
8. First admission vs. relapse or planned review admission.
9. Total number of days between admission and recruitment to the study.

Maternal and psychosocial factors

1. Age.
2. Educational level, grouped into attendance at school to Standard 6 and above, or below that level. Schooling in Malawi consists of primary (Standards 1 to 8) and secondary (Forms 1 to 4) education.
3. Marital status.
4. Occupation.
5. Number of living children.
6. Previous death of one or more of participant's own children.
7. Experience of abuse by partner. A Center for Disease Control and Prevention definition of intimate partner violence is 'physical violence, sexual violence, threats of physical/sexual violence, and psychological/emotional abuse perpetrated by a current or former spouse, common-law spouse, non-marital dating partners, or boyfriends/girlfriends of the same or opposite sex' (Beydoun *et al.* 2012). Three simple questions were posed, concerning the following aspects of intimate partner violence: being hit, being forced to have sex by a current or most recent partner, or being insulted or shouted at. A positive response to any of these questions was coded as experience of abuse by partner.
8. Wealth. This was measured using the WHO-designed assets questionnaire as used in the Demographics and Health Survey (DHS) [National Statistical Office (Malawi) & ORC Macro International, Inc. 2005]. This records information on the presence of various household items, type of water

supply, toilet, building materials and number of persons per sleeping room. A weighting for each item is given based on the distribution of the item in the Malawian population, and a validated wealth score generated.

9. Maternal MUAC.

10. Maternal HIV status and maternal report of whether or not was taking anti-retroviral treatment (ART).

Sample size

In our previous study, 71% of mothers of acute severely malnourished children in a NRU had an SRQ score ≥ 8 (Stewart *et al.* 2011). It was estimated that 50% of the mothers of inpatients of ONC and HDU would score SRQ ≥ 8 . To detect this difference with 80% power, a minimum of 94 participants were required from the NRU and 47 from each of the comparison wards.

Statistical analysis

The recruitment characteristics were compared in order to identify significant differences between the participating wards, using chi-squared tests for categorical data, analysis of variance (ANOVA) comparison of means for Normally distributed continuous data and Kruskal–Wallis tests for non-normal continuous data.

The prevalence of SRQ score ≥ 8 and the mean SRQ score were calculated for each ward. Association between ward and the proportion of participants with SRQ ≥ 8 was assessed using a chi-squared test. Association between mean SRQ score and ward was tested using one-way ANOVA.

Other variables associated with total SRQ score were identified using Pearson or Spearman correlations for continuous variables and independent samples *t*-tests for dichotomous variables. All variables associated with total SRQ score at the $P < 0.1$ significance level were entered into a linear regression model with ward-specific multiple imputation for missing data using the stata command *mi impute*. Variables entered were height for age *z*-score, child diarrhoea on admission, child diagnosed with tuber-

culosis, number of days between admission and interview, number of own living children, maternal experience of abuse by partner. Ward was entered as two separate indicator variables, ONC and HDU, with NRU as the reference category. Variance inflation factors of the independent variables entered were checked to ensure that none was above 2, which may cause problems of multicollinearity. Analyses were conducted using the Statistical Package for the Social Sciences version 20.0 (IBM Corp 2011) and Stata for Windows version 12 (StataCorp 2011).

Ethical approval

The study was approved by the College of Medicine Research Ethics Committee, Malawi and the University of Birmingham Intercolated Degree Ethics Review Committee, UK.

Results

Recruitment characteristics

During the 7-week study period, there were a total of 448 admissions to the three wards: 245 children were admitted to the NRU, of whom 162 mother–child dyads were eligible and 150 were recruited; 145 children were admitted to the HDU, of whom 96 mother–child dyads were eligible and 84 were recruited; and 58 children were admitted to ONC, of whom 38 mother–child dyads were eligible and 34 were recruited. In total, 268 of the 297 eligible mother–child dyads (90.3%) were recruited. All those eligible, but not recruited ($n = 19$) had been discharged or self-discharged before they could be recruited; there were no refusals to participate.

Of those mother–child dyads who were ineligible for recruitment, 105 (NRU 62, HDU 36, ONC 7) were not on the ward for the specified period (i.e. until commencement of transition feeding on the NRU, at least 3 days post admission on the HDU and at least 5 days post admission on ONC) either because they died, were discharged or transferred, or because the study ended. 33 (NRU 15, HDU 6, ONC 12) admissions were of children accompanied by a guardian other than their mother, 12 (NRU 5, HDU 6, ONC 1) were readmissions of mother–child dyads who had

already been recruited, and 1 mother on the NRU had severe disability.

Characteristics of mothers and children, and associations between ward and these characteristics, are shown in Tables 1 and 2.

Prevalence and severity of distress and association with ward

The prevalence of maternal SRQ score ≥ 8 was 35/150 [23.3% [95% confidence interval (CI) 16.8–30.9%]] on NRU, 13/84 [15.5% (95% CI 8.5–25.0%)] on the HDU and 7/34 [20.6% (95% CI 8.7–37.9%)] on ONC. The prevalence of SRQ score ≥ 8 was not associated with ward: $\chi^2 = 2.04$, $P = 0.36$.

The mean and median SRQ scores were 4.75 [standard deviation (SD) 3.22] and 4 [interquartile range (IQR) 3–5] on the NRU, 4.63 (SD 3.19) and 4 (IQR 3–5) on the HDU, and 5.97 (SD 3.06) and 6 (IQR 5–7) on ONC. SRQ mean score was associated at $P < 0.1$ level with ward at univariate analysis including all three wards; ANOVA: $F = 2.37$, $P = 0.096$.

Associations between total SRQ score and other variables

Categorical variables associated with SRQ total score at the $P < 0.1$ level were maternal experience of abuse by partner [mean SRQ score 6.34 (SD 3.14) vs. 4.43 (SD 3.10), $t = -4.22$ $P < 0.001$, $n = 268$], child diarrhoea on admission [mean SRQ score 5.29 (SD 3.29) vs. 4.60 (SD 3.14), $t = -1.73$ $P = 0.086$, $n = 268$], and child diagnosis of tuberculosis [mean SRQ score 8.29 (SD 3.45) vs. 4.77 (SD 3.16), $t = -2.90$, $P = 0.004$, $n = 268$].

Continuous variables associated with total SRQ score at the $P < 0.1$ level were height for age z -score (Pearson correlation -0.163 , $P = 0.016$, $n = 218$), number of own living children (Spearman correlation 0.149, $P = 0.015$, $n = 268$) and days between admission and recruitment (Pearson correlation 0.127, $P = 0.038$, $n = 268$).

SRQ score was not associated with maternal HIV status [known HIV infected: mean SRQ score 4.98 (SD 3.45) vs. not infected or unknown status: mean

Table 1. Child characteristics for each ward

Child characteristics	Nutritional rehabilitation unit	High dependency unit	Oncology ward	Total	Test statistic	P-value
Male	85/150 (56.7%)	43/84 (51.2%)	18/34 (52.9%)	146/268 (54.5%)	$\chi^2 = 0.69$	0.709
Median age (months)	21.6(IQR 15.5–28.7), $n = 150$	31.4(SD 13.8–63.6), $n = 84$	73.7(IQR 33.1–132.6), $n = 34$	24.9(15.6–43.7), $n = 268$	$K = 37.96$	<0.001
Known HIV infected	44/150 (29.3%)	2/83 (2.4%)	2/34 (5.9%)	48/267(18.0%)	$\chi^2 = 30.13$	<0.001
First admission to this ward	132/150 (88.0%)	74/84 (88.1%)	23/33 (69.7%)	232/268(86.6%)	$\chi^2 = 7.97$	0.019
Mean days from admission to recruitment	6.8 (SD 3.9), $n = 150$	3.5 (SD 1.5), $n = 84$	14.1 (SD 18.8)	6.7 (SD 8.0), $n = 268$	$F = 25.43$	<0.001
Mean admission weight-for-age z-score	-3.17 (SD 1.32), $n = 149$	-1.25 (SD 1.17), $n = 83$	-1.76 (SD 0.97), $n = 29$	-2.40 (SD 1.53), $n = 261$	$F = 68.61$	<0.001
Mean admission length-for-age z-score	-2.65 (SD 1.51), $n = 148$	-1.18 (SD 1.62), $n = 51$	-1.85 (SD 1.19), $n = 19$	-2.24 (SD 1.63), $n = 218$	$F = 18.48$	<0.001
Mean admission weight-for-length z-score	-2.12 (SD 1.37), $n = 146$	-0.72 (SD 1.22), $n = 48$	-0.60 (SD 1.21), $n = 14$	-1.70 (SD 1.48), $n = 208$	$F = 25.23$	<0.001
Diarrhoea on admission	88/150 (58.7%)	16/84 (19.0%)	0/34 (0%)	104/268 (38.8%)	$\chi^2 = 60.28$	<0.001
Diagnosed tuberculosis	5/150 (3.3%)	0/84 (0%)	2/34 (5.9%)	7/268 (2.6%)	$\chi^2 = 3.99$	0.136

Chi-squared test for categorical variables; ANOVA comparison of means or Kruskal–Wallis tests for continuous variables.

SD, standard deviation; IQR, interquartile range.

Table 2. Maternal characteristics for each ward

Maternal characteristics	Nutritional rehabilitation unit	High dependency unit	Oncology ward	Total	Test statistic	P-value
Mean age (years)	25.6 (SD 5.6), $n = 150$	26.6 (SD 5.8), $n = 84$	31.7 (SD 6.6), $n = 33$	26.7 (SD 6.1), $n = 267$	$F = 14.86$	<0.001
Mean maternal MUAC (cm)	24.6 (SD 2.5), $n = 149$	24.8 (SD 2.7), $n = 84$	26.7 (SD 4.5), $n = 34$	24.9 (SD 3.0), $n = 267$	$F = 7.20$	0.001
Known HIV infected	65/150 (43.3%)	12/84 (14.3%)	5/34 (14.7%)	82/268 (30.7%)	$\chi^2 = 25.63$	<0.001
Married	109/150 (72.7%)	75/84 (89.3%)	29/34 (85.3%)	213/268 (79.5%)	$\chi^2 = 9.93$	0.007
Abuse by partner	38/150 (25.3%)	17/84 (20.2%)	6/34 (17.6%)	61/268 (22.8%)	$\chi^2 = 1.37$	0.503
In paid employment	71/150 (4.7%)	3/84 (3.6%)	2/34 (5.9%)	12/268 (4.5%)	$\chi^2 = 0.33$	0.848
Completed standard six schooling or above	84/150 (56.0%)	55/83 (66.3%)	12/34 (35.3%)	151/267 (56.6%)	$\chi^2 = 9.46$	0.009
Number of own living children	2 (IQR 1–3), $n = 150$	2 (IQR 2–4), $n = 84$	4 (IQR 2–5), $n = 34$	2 (2–4), $n = 268$	$K = 14.37$	0.001
Currently pregnant	19/150 (12.7%)	7/84 (8.3%)	5/34 (14.7%)	31/268 (11.6%)	$\chi^2 = 1.36$	0.506
Had a previous child die	41/150 (27.3%)	19/84 (22.6%)	13/34 (38.2%)	73/268 (27.2%)	$\chi^2 = 2.50$	0.287
Mean DHS wealth index	0.56 (SD 0.89), $n = 149$	0.58 (SD 0.92), $n = 84$	0.19 (SD 0.98), $n = 34$	0.52 (SD 0.92), $n = 267$	$F = 2.58$	0.078
Mean self-reporting questionnaire score	4.75 (SD 3.22), $n = 150$	4.63 (SD 3.19), $n = 84$	5.97 (SD 3.06), $n = 34$	4.87 (SD 3.21), $n = 268$	$F = 2.37$	0.096

Chi-squared test for categorical variables; ANOVA comparison of means or Kruskal–Wallis tests for continuous variables.

SD, standard deviation; IQR, interquartile range; MUAC, mid-upper arm circumference; DHS, Domestic and Health Survey.

Table 3. Linear regression with self-reporting questionnaire total score as dependent variable, and using multiple imputation for missing data on days from admission to recruitment and child height-for-age z-score

	Unstandardised coefficients			95% confidence interval for B	
	B	Standard error	P-value	Lower bound	Upper bound
Being on oncology ward*	1.655	0.782	0.035	0.114	3.195
Being on high dependency unit*	0.976	0.494	0.050	0.002	1.950
Days from admission to recruitment	0.018	0.021	0.394	-0.023	0.058
Child height-for-age z-score	-0.278	0.140	0.050	-0.557	0.001
Child diarrhoea on admission	1.194	0.432	0.006	0.342	2.045
Child diagnosed with tuberculosis	2.897	1.162	0.013	0.609	5.185
Number of living children	0.197	0.121	0.106	-0.042	0.436
Experience of abuse by partner	1.895	0.440	<0.001	1.029	2.760

$n = 268$, ward specific mean substitution for missing data, adjusted R^2 14.2%, maximum variance inflation factor = 1.54. *Reference ward is nutritional rehabilitation unit.

SRQ score 4.82 (SD 3.16), $t = -0.372$, $P = 0.71$, $n = 268$]. Among the 82 known infected with HIV, SRQ score for those taking ART ($n = 32$) was 5.44 (SD 3.72), and for those not taking ART ($n = 49$) was 4.67 (SD 3.30), $t = 0.968$, $P = 0.336$ (missing value $n = 1$).

In the multivariate analysis, mothers of children admitted to the NRU had significantly lower SRQ scores when compared with each of the other two wards (Table 3). In addition, maternal experience of abuse by partner, child diarrhoea on admission, and child diagnosis of TB were all independent significant predictors of total SRQ score. Lower child height for age z-score did not quite reach significance as a predictor of total SRQ score ($P = 0.05$). Repeating the linear regression with maternal HIV as an additional variable did not affect the results and maternal HIV was not associated with SRQ score.

Discussion

This is the first study to demonstrate that the level of distress reported by mothers of children admitted with severe acute malnutrition to a NRU in Malawi was not greater than that of mothers of children admitted with other severe life-threatening illnesses. Contrary to the study hypothesis, NRU admission was not associated with maternal distress as meas-

ured by SRQ score on univariate analysis, and on multivariate analysis, NRU admission was associated with a lower SRQ score. In the whole sample, correlates of maternal distress were child diarrhoea on admission, child diagnosed with tuberculosis, and maternal experience of abuse by partner. There was a trend for a negative association between maternal distress and child height for age z-score.

These results need to be interpreted within the context of the strengths and limitations of the study. Study strengths include the use of locally validated measures, the high response rate with no refusals, and the consideration of a range of potential risk factors previously shown to be associated with psychological distress. The main limitation was the small number ($n = 34$) of mother-child dyads recruited from the oncology ward, as there were fewer inpatients on this ward during the study period. As a result, this sample may not be representative of all oncology admissions. In addition, the prevalence of marked distress was lower than we had expected, so the study may have been underpowered to test our hypothesis. In spite of these limitations, our findings do not support the hypothesis that poor maternal psychological well-being is associated with child admission for acute severe malnutrition.

This negative result may also reflect the much lower prevalence of marked distress ($SRQ \geq 8$;

23.3%) compared with our 2006 study on the same NRU (70.9%; Stewart *et al.* 2011). It is possible that there were differences between the two studies in the performance of the SRQ. This is unlikely, however, as the SRQ is highly structured and it was one of the 2006 data collectors (TN) who collected the data during the 2012 study. The reduction may instead reflect a number of other important differences between the two studies.

Firstly, during the previous study, there was greater national food insecurity in Malawi. NRU ward staff recalled that mothers attending inpatient children in 2006 were particularly concerned about the welfare of the remaining family living at home. Comparison of child anthropometry in the NRU between 2006 and 2012 suggests more severe malnutrition in 2006 (2006 vs. 2012: mean weight-for-age z-score -3.68 vs. -3.17 , height-for-age z-score -2.95 vs. -2.65 , weight-for-height z-score -2.58 vs. -2.12), although routinely collected ward mortality figures in 2006 and 2012 were similar (20.8% vs. 24.9%).

Other potentially relevant differences between mothers in the 2006 and 2012 studies were the percentage who had completed standard six schooling or above (40.2% vs. 56%), having had a previous child die (37% vs. 27.3%) and DHS wealth index (0.30 vs. 0.56).

Another potential explanation for the difference may be that stigmatisation and hopelessness associated with HIV has reduced since 2006. This is especially relevant within the NRU, where child and maternal HIV rates are particularly high. In 2006, 44.7% of mothers knew their status, of which 33.9% were infected; in 2012, these figures were 97.3% and 44.5%. In 2006, 30.3% of the children were infected vs. 29.3% in 2012. Antenatal testing is now more widespread so more mothers would already know their status prior to the child's admission; pre- and post-diagnostic counselling are available within the hospital; and mothers on the ward encourage one another to have an HIV test. There is much wider, reliable access to free ART, which can be accessed at district health centres rather than only urban hospitals. It is of note, however, that we did not find an association between prescription of ART and distress among HIV-infected mothers.

Lastly, changes in the NRU ward environment may have been important. Previously, the NRU was small, congested and dark. However, since 2006, a new ward has been built for nutritional rehabilitation, which is much larger, with dividers between the beds to allow a degree of privacy, bright wall murals, large windows and a separate prayer room and playroom. The new ward separates the sickest children into a special high-dependency room, which may be particularly important given the high mortality rates on this ward. Mothers are also provided with tea, sugar, maize and cooking oil, which minimises the financial impact of the inpatient stay and is likely to have a positive influence on physical and psychological health. Importantly, increased community rehabilitation because of the development of an Outpatient Therapeutic Programme has resulted in a halving of admissions since 2006, which means that the ward is less overcrowded and there is less strain on health care professionals. Each mother is now thoroughly counselled regarding her rights, her role in her child's rehabilitation and the importance of HIV testing. The mothers also receive group training in how to support child nutrition and are counselled individually upon discharge, giving them an active role in rehabilitating their child. Improved rapport between the mother and health care professionals also creates an improved support system for service users, with more mothers approaching the ward staff with their problems.

It is notable that two of the four variables associated with SRQ score on multivariate analysis were child health factors; diarrhoea on admission and having diagnosed tuberculosis (although rare) were independent correlates of marked maternal distress. Child height-for-age z-score fell only just outside significance as a predictor of maternal distress. This finding may suggest that that maternal distress may be associated with chronic undernutrition, but not with severe acute malnutrition requiring NRU admission. However, a limitation of this study was the high number of missing values for child height. We corrected for this using ward-specific multiple imputation for missing data. However, child height values were not missing at random with greater numbers missing from HDU and oncology than the NRU where there is a particular focus on anthropometry.

It is of note that the child health factors (diarrhoea, TB and stunting) are more prevalent on the NRU than the other two wards, and that once these were accounted for on multivariate analysis, mean SRQ scores were lower on the NRU vs. the other wards. This would support the suggestion that it is the child illness factors that are important associations with maternal distress rather than any deleterious effect of the ward environment.

One possible explanation for the finding of lower distress on the NRU vs. the other wards after multivariate analysis is the different timings of data collection on the three wards. On the NRU, mothers were interviewed when the child moved to transition feeding, which is an indication that the child's condition is improving. Interviews on the HDU were done at 3 days post admission when the child's condition may not necessarily have clearly improved. Similarly, on the oncology ward interviews were done at least 5 days post admission, but, given the length of chemotherapy and the risk of disease recurrence, mothers may not perceive an improvement in the child's condition. A limitation of this study is that we did not enquire about mother's perception of the child's recovery and prognosis, and further research regarding this is warranted.

The association of maternal distress with diarrhoea is consistent with our previous study on the NRU and with our study of mothers attending a child health clinic (Stewart *et al.* 2008, 2011). In studies from rural Pakistan, Rahman *et al.* (2007) suggest that one reason for the association they found between maternal depression and frequency of infant diarrhoea might be "...that disability associated with depression may interfere with child-care activities, hence putting the child's health at increased risk". This is supported by their finding that treatment of depression was associated with a reduction in infant diarrhoeal episodes (Rahman *et al.* 2008). In relation to our findings, it is plausible that maternal distress could play a part in the risk of developing diarrhoea as well as chronic undernutrition, and this is so across the whole sample; maternal distress should not be regarded as solely a reaction to the severe illness of the child.

This study found that maternal distress was associated with experience of abuse by partner. Study participants commonly experienced abuse by a partner, with 22.8% of the total participants and 41.8% of participants with marked distress reporting experience of being hit, forced to have sex or being shouted at/insulted. There is a strong association between intimate partner violence and depression; a meta-analysis of US studies estimated that 9–28% risk of depression could be attributed to exposure to intimate partner violence (Beydoun *et al.* 2012). Intimate partner violence has been found to be a correlate of poor maternal psychological well-being in Nigeria (Ola *et al.* 2011) and South Africa (Hartley *et al.* 2011). Of note, a case control study from Brazil found that severe intimate partner violence was associated with childhood undernutrition, although the role of depression in that study is not known (Hasselmann & Reichenheim 2006). In our study, experience of abuse by partner was not associated with admission to NRU.

It is not possible to generalise our results to community or even other hospital settings in Malawi and other sub-Saharan African countries; the QECH paediatric department is a tertiary referral unit in a teaching hospital that receives significant external financial and skills input. A limitation of this study in understanding the relationship between maternal distress and childhood severe acute malnutrition is that it was only focused on an inpatient NRU. There is increased community-based management of uncomplicated malnutrition and further research should be focused in such settings.

The association between poor maternal mental health and child undernutrition is well established from longitudinal studies in LMIC (Surkan *et al.* 2011) although there are conflicting results in sub-Saharan Africa (Tomlinson *et al.* 2006; Adewuya *et al.* 2008; Medhin *et al.* 2010). This study, and our earlier finding that maternal distress did not predict infant weight gain at 4 weeks post discharge from an NRU (Stewart *et al.* 2011), suggest that maternal mental health may be a less important issue in childhood acute severe malnutrition than in chronic undernutrition. Given these findings, further prospective studies are needed to clarify the role of maternal psychological well-being and child undernutrition.

Such studies would need to be population-based and should include investigation of whether poor maternal psychological well-being is a predictor of long-term outcome following an episode of severe acute malnutrition.

Our study is a clear reminder of the high level of maternal distress associated with hospital admission of severely ill young children. These mothers should be offered support, such as that now offered at the QECH NRU. Comparison of this study with our earlier NRU study suggests that high levels of distress might be mitigated by a caring, positive and less stigmatising environment. Further research is needed regarding this, in particular to identify what changes in environment and practice would be feasible and effective in district NRUs and community-based programmes.

Conclusion

In conclusion, this study suggests that our previous finding of very high levels of distress among mothers of children admitted to a NRU may have reflected the particular circumstances at that time and not a general tendency for higher maternal distress on a NRU compared with other medical units. Our findings also suggest that further prospective studies are needed to clarify the possible contributory role of poor maternal psychological well-being to chronic child undernutrition and diarrhoea in sub-Saharan Africa.

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Conflicts of interest

The authors declare that they have no conflicts of interest.

Contributions

SC and RS were joint lead investigators and had equal roles in the study design and conduct, data analysis and manuscript drafting. CM and FC supervised the project and contributed to project design, analysis and manuscript drafting. NK was involved in study design, data interpretation and manuscript drafting. BT analysed and interpreted the data. All authors approved the final manuscript.

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