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Food insecurity, childhood illness and maternal emotional distress in Ethiopia

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Abstract

Objective: The relationship between food insecurity, maternal emotional distress and childhood morbidity in resource-poor settings is not well clarified. The present study aimed to assess independent associations between household food insecurity and childhood morbidity and potential modifications by maternal emotional distress.
Design: A cross-sectional survey. A food security scale was used to assess household food insecurity; maternal reports were used to assess recent childhood illness; and the Hopkins Symptom Checklist was used to assess symptoms of emotional distress among mothers.
Setting: The Oromia Region, Ethiopia (rural area).
Subjects: A total of 936 mother–child pairs.
Results: Of 936 children assessed, 22·4% had experienced diarrhoea, 20·7% had cough and 21·5% had fever in the 2 weeks preceding the interview. Household food insecurity was reported by 39% of mothers. Greater food insecurity and greater maternal emotional distress were each independently associated with higher prevalence of cough and fever. Among mothers with low emotional distress, food insecurity was associated with a 2·3 times greater odds of diarrhoea in their children.
Conclusions: Household food insecurity may increase the risk of childhood illness in rural Ethiopia, and children having mothers with greater emotional distress may be at highest risk. These findings highlight the importance of strengthening policy initiatives aimed at reducing the high prevalence of food insecurity and emotional distress in Ethiopia.

Keywords
Food insecurity
Childhood illness
Maternal mental health
Ethiopia

Food insecurity is defined as 'limited or uncertain availability of nutritionally adequate and safe foods or limited or uncertain ability to acquire food in socially acceptable ways'[1]. A significant public health and human rights issue in many low-income countries, food insecurity is highly prevalent in many countries in the Global South and is a significant determinant of multiple childhood health outcomes[2–7].

Three mechanisms have been identified to explain the association between food insecurity and childhood illness. First, food insecurity may be associated with childhood illness because it functions as an indicator of wealth, and wealthier households tend to have healthier children[8]. Thus, children from poor families may suffer from malnutrition, which increases the risk of infectious disease, particularly diarrhoeal disease, lower respiratory tract infection, tuberculosis and measles. Second, food-insecure households may be less likely to engage in high levels of health-care-seeking behaviour, as they may be unwilling or unable to spend resources on childhood health-care because they have to spend their limited resources on food[9].

Third, food insecurity may be associated with childhood illness through its relationship with maternal psychological well-being. Several studies have identified an association between household-level measures of food insecurity and hunger and symptoms of common mental disorders among mothers, which may in turn affect child-care practices. A study of 400 women in rural Tanzania[10] showed that women in food-insecure households scored significantly higher on a measure of symptoms of anxiety and depression. Similar findings have been reported in African and Indian settings[11]. We have shown elsewhere that household food insecurity in this rural Ethiopian sample is associated with maternal and paternal symptoms of anxiety and depression[12]. The finding that food

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insecurity is associated with symptoms of mental disorders is consistent with a wealth of anthropological data[13], as well as with studies from high-income countries[14]. Maternal depression has been found to be associated with poorer child-care behaviours, decreased childhood psychosocial development and functioning and decreased childhood health and nutritional status in both low- and high-income countries[15–21].

These relationships may be of particular importance to public health in sub-Saharan African (SSA) countries where childhood illnesses such as diarrhoea, acute respiratory infection and fever are responsible for considerable short-term and long-term disability and mortality[22]. Food insecurity affects over one-third of households in SSA[23], and the number of food-insecure households in SSA is predicted to double by 2020[24]. In several SSA countries, the impact of food insecurity is likely substantial: in Ethiopia, which was the setting of our current study, over 50 % of the population was undernourished in 2002, with 31 % and 15 % of children under 5 years of age suffering from chronic and acute malnutrition, respectively[25,26].

Although current evidence indicates a high prevalence of both food insecurity and childhood illnesses in Ethiopia, little research has examined this relationship in low-income countries, and to our knowledge no research of this type has been conducted in Ethiopia. Similarly, although one recent analysis shows that maternal depression can be a modifier of the relationship between food insecurity and childhood health in a high-income country[27], to our knowledge no analyses have assessed the indicators of maternal mental disorders or distress as a potential modifier of the relationship between food insecurity and childhood illnesses in Ethiopia. We believe that it is important to recognize that maternal psychological well-being may play an important role in increasing the likelihood of childhood illnesses.

The objective of the present study was to examine the association between experience of household food insecurity, maternal emotional distress (i.e. anxiety and depressive symptoms) and childhood illnesses in families living in a rural area in Ethiopia. We had three hypotheses: (i) food insecurity would predict childhood illnesses even after controlling for potentially confounding individual- and household-level factors; (ii) maternal emotional distress would predict the occurrence of common childhood illnesses; and (iii) the impact of food insecurity on childhood illness would be greatest in households with mothers suffering from high emotional distress.

Materials and methods

The present study was conducted in rural Ethiopia in the Gilgel Gibe Field Research Center (GGFRC), which is located around the Gilgel Gibe Hydroelectric Dam. The GGFRC is located in the Jimma zone within the Oromia region in south-west Ethiopia. It is approximately 55 km from Jimma town and 260 km from Addis Ababa. This is a primarily rural area and the principal occupation is subsistence agriculture. Jimma University conducts an ongoing complete demographic surveillance in the GGFRC, which collects vital data for a complete census of the population comprising more than 8000 households in the area. This census is part of a network of surveillance systems in Ethiopia aimed at a comprehensive assessment of population health. Records are updated several times each year and the community supports these activities.

The Gilgel Gibe Growth and Development Study (GGGDS) was a cohort study of families drawn from the demographic surveillance area focused on adult mental health and childhood development. The study involves questionnaire and anthropometric information collected from the parents of children aged 9–30 months and from developmental assessments conducted on the children. The data analysed in the present study were collected in June and July 2007. A structured questionnaire was developed and administered to participants by nine interviewers. The questionnaire included 159 questions on: children's developmental milestones; caregiving and feeding practices; access to health-care and children's immunization status; maternal anxiety and depression and past traumatic events; and socio-economic status (SES) of the household. Questionnaires and consent documents were developed in English and translated and back-translated into Amharic and Affan Oromifa. Interviewers took a week-long training course that included practice interviewing and role-playing. Following training, interviewers undertook a pilot study in the nearby communities outside the GGFRC and the data were checked for consistency, outliers and for missing values. After the pilot study, interviewers and investigators met to discuss experiences and issues and to finalize the questionnaire. The final questionnaires for men and women were administered separately to husbands and wives at their houses in a private area. Written informed consent was obtained from all participants. The Institutional Review Boards of the University of Michigan, Jimma University and Emory University reviewed and approved the study protocol. The study size comprised 1016 households. All data were de-identified. A total of 1016 maternal or children's questionnaires and 960 paternal questionnaires were completed.

Outcome variables

We used four dichotomous measures of recent childhood illness as outcome measures. Mothers were asked whether their child had had diarrhoea, cough (an identifiable symptom of respiratory tract infections) or fever (an identifiable symptom predominantly of malaria) in the past 2 weeks before the date of interview. One outcome variable was created for each illness: if the mother reported that the child had experienced the illness in the past 2 weeks, the illness was coded as 1; otherwise it was coded as 0. A fourth outcome variable indicating whether

the child had had any one of the illnesses was created by summing the values of 'diarrhoea', 'cough' and 'fever', and coding 1 if the sum was ≥1 and as 0 if the sum was 0.

Primary predictors

Household SES was measured by asking husbands to respond to a set of material assets, stating whether or not the household possessed each asset, and coded as 1 if the household possessed the asset and 0 if the household did not possess the asset. The set of items included twenty assets, including various types of livestock, electronic equipment, household characteristics and house ownership. Women provided corresponding responses to some of the material items and these were highly associated with their partner's responses. Therefore, we used the responses of men as indicators of household SES. Items were summed and household SES was categorized on the basis of whether the household's summed item total was in the highest, middle or lowest tertile.

Household-level food insecurity was measured using a seven-item scale based on those used and validated previously in diverse settings in low-income countries[28–30]. Mothers and fathers were asked separately whether in the past 3 months: (i) they had worried about running out of food; (ii) they had run out of food; (iii) they had reduced the variety of food for children; (iv) children had not had enough to eat; (v) the respondent or another adult had not eaten enough; (vi) the respondent had spent the whole day without food; and (vii) the household had ever had to ask others for food or money to buy food. These items were scored as yes/no and the analysis showed that the scale had high internal consistency for both mothers (Cronbach's $\alpha = 0{\cdot}93$) and fathers (Cronbach's $\alpha = 0{\cdot}92$). We summed across all items. Respondents giving a positive answer to five or more items on the scale were coded with a value of 1, indicating food insecurity, with the remaining respondents being coded as 0, indicating no food insecurity. Food security scores from the mother's and father's questionnaire showed substantial agreement with food insecurity (>4), with $\kappa = 0{\cdot}66$, and were highly correlated (Spearman's $\rho = 0{\cdot}71$, $P < 0{\cdot}0001$). Food security questions from the maternal questionnaire were used for the food insecurity score variable.

We used the Hopkins Symptom Checklist-25 (HSCL) to assess maternal emotional distress. The HSCL is an inventory of anxiety and depressive symptoms and has been used and validated in a range of culturally and economically diverse settings[31,32]. The instrument has been used extensively in vulnerable populations, such as in war survivors, and in a range of cross-cultural contexts including Tanzania[13]. For each item, respondents are asked to identify whether they have experienced the symptom and the severity of the symptom was assessed on a 4-point Likert scale in the 2 weeks before the survey. These included statements such as 'In the past week how bothered have you been by your heart pounding or racing?'. We summed across all items to create a total score and divided this score into tertiles, creating a variable for maternal emotional distress, coding the lowest tertile as 0, the middle as 1 and the highest as 2. We were interested in examining the relationship between childhood illness and maternal distress across a range of levels of maternal distress, thus examining women across three levels of distress. The scale showed good internal consistency (Cronbach's $\alpha > 0{\cdot}90$) and was significantly correlated with stressful life events and with greater reported difficulty in consuming and cooking meals, engaging in farm work, household chores, socializing and maintaining personal hygiene (all $P < 0{\cdot}05$). The scale, therefore, appears to have adequate internal and external validity but is not a diagnostic tool and has not been validated in the rural Ethiopian setting. We assume, however, that higher scores are indicative of a greater likelihood of emotional distress.

Control variables

Four control variables were included in the analysis to specify the relationship between food insecurity and childhood illness properly. We included covariates that could be predictive of food insecurity and childhood illness outcomes, which could be driving the associations found between these variables. These were maternal age (years), maternal education (years), children's age (months) and children's gender.

Statistical analyses

Univariate statistics were used to describe the sample, the prevalence and distribution of key independent variables, and to report the prevalence of diarrhoea, cough, fever and any illness in children. The χ^2 test and Student's t test were used to assess the associations between the hypothesized predictor and outcome variables. The χ^2 test was used to assess associations between the hypothesized moderator variable and both predictor and outcome variables.

Logistic regression was performed to test the relationship between food insecurity and childhood illness (diarrhoea, cough, fever or any illness) while controlling for household-level (i.e. SES) and individual-level covariates. To examine whether the relationship between food insecurity and childhood illness was modified by maternal distress, interaction terms were created between food insecurity and maternal emotional distress and were assessed for statistical significance ($P < 0{\cdot}05$). Each childhood illness was modelled separately and a model was fit to the 'any illness' outcome. Predicted probability plots of common childhood illnesses by both food insecurity status and maternal emotional distress were constructed to show the magnitude of the bivariate associations. Significant interactions were analysed using subgroup analysis. The criterion for statistical significance was set at 0·05. OR with 95 % CI was used to test the strength of association between predictor and outcome variables. All statistical analyses were carried out using the SAS statistical software package version 9·1 (SAS Institute, Cary, NC, USA).

Results

Complete data were available for 936 mother–child pairs. Table 1 shows the individual and household characteristics of this sample. Over one-third (38·9%) of all mothers reported household food insecurity, defined as a score of ≥5 out of a possible score of 7. The mean age of mothers responding to the survey was 26·5 (SD 5·6) years. The mean number of school years completed for the mothers was 0·7 (SD 2·0) years. The mean age of the children was 21·2 (SD 6·6) months. Just over half of the children were boys.

Approximately one-fifth (22·4%) of mothers reported that their child had experienced diarrhoeal symptoms in the past 2 weeks. Similarly, 20·7% reported that their child had experienced cough symptoms in the past 2 weeks and 21·5% reported that their child had experienced fever symptoms in the past 2 weeks. Comorbidity was common: 14·7% had experienced one of the illnesses in the past 2 weeks, 11·0% had experienced two and 9·2% had experienced all three illnesses.

Bivariate analysis

Children were significantly more likely to have had cough (26% *v.* 18%, $P<0·01$), fever (25% *v.* 19%, $P<0·05$) or more than one illness (41% *v.* 31%, $P<0·001$) in the past 2 weeks if their mother reported household food insecurity than if their mother had not reported household food insecurity. Children were also significantly more likely to have had cough (26% *v.* 21% *v.* 15%, $P<0·01$), fever (28% *v.* 22% *v.* 15%, $P<0·001$) or one or more illnesses (42% *v.* 33% *v.* 29%, $P<0·001$) if their mother suffered higher emotional distress (compared with medium and low emotional distress). Mothers in food-insecure households were significantly more likely to suffer from high emotional distress compared with mothers in food-secure households (46% *v.* 25%, respectively, $P<0·0001$). The predicted probability of all three illnesses was higher in food-insecure houses than in those that were food secure (Fig. 1). Similarly, the predicted probability of illness increased with increasing severity of symptoms of maternal emotional distress (Fig. 2). Children with illnesses were significantly younger than those without illnesses in the case of diarrhoea (mean = 19 *v.* 22 months, respectively, $P<0·0001$), fever (mean = 20 *v.* 21 months, $P<0·001$) and one or more illnesses (mean = 20 *v.* 22 months, $P<0·0001$). Illness was not associated with children's gender, maternal age, maternal education or SES (Table 2).

Table 1 Household and individual characteristics of participants in Gilgel Gibe, 2007

Household and individual variables	%
Socio-economic status	
Low (0–6 items)	34·3
Moderate (7–8 items)	34·4
High (9–20 items)	31·4
Food security (summed food-secure score ≤4)	
Secure	68·1
Insecure	38·9
Mother's age (years)	
Mean	26·5
SD	5·6
Mothers with <1 year of education	84·1
Maternal emotional distress	
Low	32·9
Moderate	32·0
High	35·1
Gender of child	
Male	52·2
Female	47·8
Child's age (months)	
Mean	21·2
SD	6·6
Children with diarrhoea in the past 2 weeks	22·4
Children with cough in the past 2 weeks	20·7
Children with fever in the past 2 weeks	21·5
Children with any illness (diarrhoea, cough or fever) in the past 2 weeks	35·1

Multivariate analysis

In the multivariate models (Table 3), food insecurity was a significant predictor of diarrhoea (OR = 1·44, 95% CI

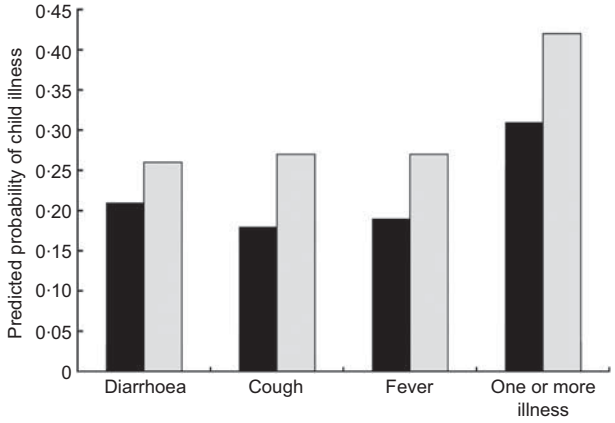

Fig. 1 Predicted probability of child illness by food-security level in Gilgel Gibe, 2007 (■, food secure; □, food insecure)

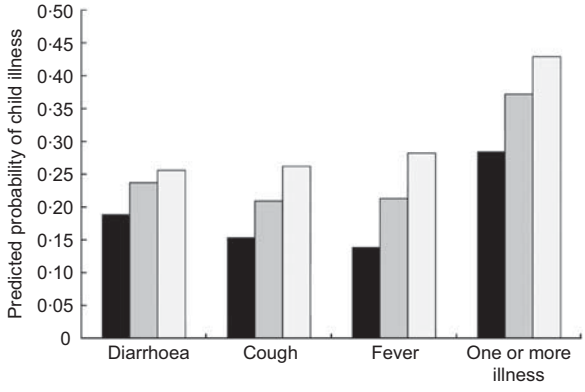

Fig. 2 Predicted probability of child illness by maternal emotional distress (MED) level in Gilgel Gibe, 2007 (■, low MED; ▒, moderate MED; □, high MED)

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Table 2 Bivariate associations between predictor variables and childhood illnesses in Gilgel Gibe, 2007†

	Diarrhoea in the past 2 weeks	Cough in the past 2 weeks	Fever in the past 2 weeks	Any illness in the past 2 weeks
	%	%	%	%
Food security				
Secure	20·8	17·5	19·1	31·1
Insecure	24·8	25·7	25·4	41·3
P	0·14	<0·01	0·02	<0·01
Maternal emotional distress				
Low	18·7	15·2	14·6	28·9
Medium	23·4	21·0	22·2	32·7
High	24·9	25·5	27·5	42·9
P	0·13	<0·01	<0·01	<0·01
Gender of child				
Male	21·6	21·2	22·0	35·8
Female	23·1	20·0	20·9	34·1
P	0·54	0·63	0·68	0·57
Socio-economic status				
Low (0–6)	24·9	21·9	22·1	38·3
Moderate (7–8)	21·1	18·7	21·7	33·0
High (9–20)	22·8	23·6	22·6	35·4
P	0·52	0·31	0·97	0·38
Mother's age (years)				
Mean	26·3	26·8	26·7	26·6
SD	5·3	5·8	5·8	5·5
P‡	0·41	0·44	0·66	0·89
Mother's education (years)				
0	22·6	21·0	21·8	35·3
≥1	21·7	18·6	20·0	33·8
P	0·82	0·50	0·62	0·71
Child's age (months)				
Mean	18·74	20·5	19·6	19·8
SD	6·4	6·8	6·5	6·5
P‡	<0·01	0·13	<0·01	<0·01

†Unless otherwise noted, *P* values represent χ^2 test results.
‡Student's *t* test.

Table 3 Multivariate logistic equation models predicting childhood illness, Gilgel Gibe, 2007

	Diarrhoea		Cough		Fever		Any illness	
Variable	OR	95 % CI	OR	95 % CI	OR	95 % CI	OR	95 % CI
Food insecurity	1·44*	1·03, 2·02	1·42*	1·04, 2·02	1·53*	1·09, 2·14	1·56**	1·16, 2·09
Emotional distress†								
Middle	1·29	0·85, 1·94	1·35	0·90, 2·10	1·57*	1·03, 2·48	1·09	0·80, 1·62
High	1·50	0·98, 2·24	1·81**	1·18, 2·72	2·41****	1·50, 3·62	1·78**	1·23, 2·50
SES†								
Middle	0·85	0·58, 1·26	0·88	0·59, 1·30	1·14	0·73, 1·57	0·88	0·63, 1·22
High	1·11	0·71, 1·64	1·27	0·89, 2·02	1·30	0·87, 2·02	1·09	0·80, 1·57
Child sex	1·02	0·74, 1·40	0·95	0·69, 1·32	0·99	0·71, 1·35	0·88	0·67, 1·17
Maternal age	1·00	0·97, 1·02	1·00	0·98, 1·01	1·00	0·97, 1·03	1·00	0·98, 1·02
Maternal education	1·09	0·71, 1·65	1·14	0·72, 1·78	1·23	0·77, 1·88	1·21	0·78, 1·66
Child age	0·93****	0·91, 0·95	0·98	0·96, 1·00	0·95****	0·93, 0·97	0·95****	0·93, 0·97

SES, socio-economic status.
*$P<0·05$,**$P<0·01$,***$P<0·001$,****$P<0·0001$.
†Compared with referent group (low).

1·03, 2·02), cough (OR = 1·42, 95 % CI 1·04, 2·02), fever (OR = 1·53, 95 % CI 1·09, 2·14) and one or more illness (OR = 1·56, 95 % CI 1·16, 2·09) after controlling for individual and household variables and potential confounders. Moderate levels of maternal emotional distress was a significant predictor of fever (OR = 1·57, 95 % CI 1·03, 2·48), and high levels of emotional distress were predictive of cough (OR = 1·81, 95 % CI 1·18, 2·72), fever (OR = 2·41, 95 % CI 1·50, 3·62) and any illness (OR = 1·78, 95 % CI 1·23, 2·50), after controlling for confounders. Younger age of children remained a significant predictor of diarrhoea (OR = 0·93, 95 % CI 0·91, 0·95), fever (OR = 0·95, 95 % CI 0·93, 0·97) or one or more illness (OR = 0·95, 95 % CI 0·93, 0·97), but not of cough (OR = 0·98, 95 % CI 0·96, 1·00). SES, children's sex and maternal age and education were not significant predictors of childhood illness.

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We fit several models with interactions and performed subgroup analysis to explore our third hypothesis. The association between diarrhoea and food insecurity was modified by maternal emotional distress. Among families in which the mother was not suffering from emotional distress, children from food-insecure households were more than twice as likely to have diarrhoea (OR = 2·33, 95% CI 1·58, 3·11). However, among families in which the mother was suffering from emotional distress, food insecurity was not a risk factor for diarrhoea (OR = 0·87, 95% CI 0·22, 3·49). In our subgroup analysis, among families that were food secure, children having mothers with high emotional distress were 2·3 times as likely to have diarrhoea (OR = 2·30, 95% CI 1·69, 2·94). Among food-insecure families, maternal emotional distress was not a risk factor for diarrhoea (OR = 0·84, 95% CI 0·44, 1·61).

Discussion

In the present representative sample of households in a rural area of Ethiopia, we found that household food insecurity and maternal emotional distress were independent predictors of children having had illness in the 2 weeks before the survey. We found that maternal emotional distress modified the relationship between household food insecurity and diarrhoea.

Food insecurity status was associated with increased risk of diarrhoea, cough or fever, independent of children's gender and age, mothers' age and educational level, and SES. These results are consistent with similar studies from high-income countries[7]. To our knowledge, our study is among the few to use an experience-based food security measure to assess the association between food insecurity and childhood health outcomes, and these results are particularly pertinent in Ethiopia's chronically food-insecure environment[33]. Because this association between food insecurity and all childhood illnesses was found after controlling for SES, it appears that factors beyond SES and food availability influence the risk of childhood illness. A possible hypothesis is that stress due to food insecurity and the accompanying maternal distress may affect child-care behaviours, which in turn may lead to childhood illness. Furthermore, the risk of childhood malnutrition, another risk factor for childhood illnesses, may increase with increasing food insecurity.

Maternal emotional distress was also associated with increased diarrhoea, cough or fever risk, independent of children's gender and age, mothers' age and educational level, and SES. These results are consistent with results from a cohort study conducted in Pakistan, which found that the relative risk of diarrhoea in infants with depressed mothers was 2·5 times greater than that for infants with mothers not suffering from depression[20]. The consistency of our results with those in other contexts suggests that the scale is an accurate indicator of emotional distress. We also found that the association between food insecurity and diarrhoea was modified by maternal emotional distress. Our results show that, among mothers without emotional distress, children in food-insecure households were more than twice as likely to have had diarrhoea or one or more illnesses; however, among mothers with emotional distress, food insecurity did not predict any childhood illness. This result was contrary to our hypothesis that the impact of food insecurity on childhood illness would increase as maternal distress increased. One explanation for this unexpected result is that mothers with high emotional distress have poor care practices regardless of their food security status; as a result, food security status may not affect their child's health. Nevertheless, these results highlight the impact of both food insecurity and maternal mental health on childhood health outcomes in the chronically food-insecure context of rural Ethiopia.

One explanation for the association between maternal emotional distress and childhood illness is that depressed mothers display poor health-seeking behaviours[15]. Distressed mothers can be more withdrawn in their interactions with their children, and provide care for their children in different ways[34,15]. Poor mental health may have an impact on the demanding task of child-care and may lead to a decrease in the quality of care, as well as in feeding and health-seeking behaviours[35].This difference in feeding behaviours between distressed and non-distressed mothers could have important implications for childhood health, as a less active role in their children's feeding and care is linked to decreased nutrient intake and childhood development[36–38]. Good child-care practices have been shown to be an effective means by which to mitigate the effects of poverty on children's nutrition[39]. Depressed mothers may also have poorer care practices, particularly during critical times of childhood illness. These feeding and care practices may have an effect on childhood illnesses in our study sample.

The household food insecurity measure that we used appears to be a valid tool in rural Ethiopia for several reasons. The least severe items were endorsed at a higher frequency compared with the most severe items. Household food insecurity also predicted the independently reported food security status of youth living within those households, as well as lower dietary diversity and lower animal-source food consumption. Further, households with higher incomes were less likely to be categorized as food insecure ($P < 0·001$)[40,41]. This association found between food insecurity and income and dietary diversity is similar to the analytical strategy used in a validation study of the US Department of Agriculture's (USDA) food security scale in Brazil[42]. The high consistency that we found between both mothers and fathers also suggests that the scale is understandable and the results repeatable in this linguistic and cultural context. Other studies have also reported on the psychometric properties of a modified USDA food security scale, finding that food insecurity is strongly

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associated with measures of mental health morbidity[10,42]. The consistency of these results to our study's results lends further strength to our measure of food insecurity.

The present study has several limitations. First, the study is based on a cross-sectional analysis, and as such we are limited in our ability to determine the direction of association between exposures to food insecurity and subsequent childhood illness. Thus, families with chronically ill children may be more at risk for food insecurity because of increased resources being used to treat sick children. However, a US cohort study has found an inverse association between household food insecurity and children's cognitive development and weight gain[18], suggesting that there is a mechanism linking food insecurity with poor childhood health and development. Our results may indicate that a similar mechanism exists in the setting of a low-income country.

The HSCL has not, to our knowledge, been validated in rural Ethiopian populations, and thus no conclusions can be drawn on the clinical psychiatric diagnoses in the study population. However, the HSCL has been used in many different contexts and has been found to be a valid tool in populations subjected to emergency situations[43,44]. We assume that higher scores indicate higher levels of distress, as indicated in all other settings where it has been applied. In addition, because scores were significantly associated with perceived functioning, it appears to have adequate external validity[45]. A final limitation of the present study is that both predictor (food insecurity) and outcome (childhood illness) variables were determined using recall from the mother, thus creating the possibility for same-source bias. We chose to use the mothers' recall of food insecurity because women are generally responsible for food preparation in a household and are thus the best source for an accurate assessment of household food insecurity[46]. Mothers' and fathers' measures of food insecurity in our survey showed a high level of agreement ($\kappa = 0{\cdot}66$).

Future research

An ethnographic study examining the type of care behaviours affected by food insecurity and maternal mental health would help elucidate the findings of the present study further. In addition, future studies should collect information on caregiver's health-seeking behaviour in both food-secure and food-insecure households to assess the impact of limited resources on health-seeking behaviour. Finally, data collection efforts should include indicators of childhood health that do not rely on maternal recall.

Policy implications

Our findings suggest that even by the age of 2 years a family's food security status may have an impact on a child's propensity to contract diarrhoeal, respiratory and fever-causing infections in a rural Ethiopian community, and that children with mothers experiencing high emotional distress are more likely to contract these illnesses. The findings highlight the importance of strengthening policy initiatives aimed at reducing the high prevalence of food insecurity in Ethiopia and the role of maternal symptoms of mental disorders, which must be treated in order to maximize childhood health. Such efforts will contribute to increasing the quality of child-care practices, as well as contribute to young children's development in this chronically food-insecure environment.

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