Maternal Resources and Household Food Security: Evidence from Nicaragua

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Abstract

Women (especially mothers) are theorized as critical to reducing household food insecurity through their caregiver and work roles. This study empirically tests these assumptions, assessing how maternal economic and social resources are associated with food insecurity in households with young children. Data from a new population-based sample of households with young children (age 3-10) was collected in León, Nicaragua (N=443), including a validated measure of household food insecurity (ELCSA) and maternal resource measures. Regression results suggested that when mothers contributed substantially to household income the odds of moderate/severe household food insecurity were 34% lower than when their spouse/partner was the main provider. When mothers managed household economic resources, the odds of food insecurity were 60% lower than when resources were managed by someone else. Low maternal education, single-mother status, and lower social support also contributed significantly to higher odds of food insecurity net of household economic resources and demographics.
Results are similar in models of adult- and child-specific food insecurity. This research provides new evidence that maternal economic and social resources are important for reducing household food insecurity and adult- and child-specific food insecurity. Women's social status, social support, and access to economic resources need to be enhanced as a part of policies aimed to reduce food insecurity in high-poverty settings.

Introduction

Food insecurity is a critical public health problem, with one in eight people around the world lacking consistent access to food to meet their needs for a healthful life (1). The food insecure often have diets that are less diverse (2, 3) and of lower energy content, leading to poorer nutritional status (4, 5) and increased rates of child illness (6). Further, there is mounting evidence that household food insecurity is associated with poor mental health (7) and maternal distress (6). Thus, food insecurity poses a serious threat to individual well-being and undermines national-level productivity, particularly in low-income countries where a substantial number of people are food insecure.

Food insecurity is often measured at the household level, where food is purchased, produced, prepared and distributed. Understanding the social determinants of household food insecurity is important for designing public health policies and programs to increase individuals' access to food in poor settings. Lack of economic resources is the most studied risk factor for household food insecurity in low-income countries (8-10), and is important for food security as households increasingly rely on purchased foods throughout the developing world (11). However, not all poor households are food insecure and factors other than household income may be important determinants of food insecurity, as a recent review of research suggests (12).

This study expands our understanding of the determinants of food insecurity in low-income countries by focusing on mothers' access to economic and social resources as key to reducing food insecurity in households with children. This is a critical area of research, since policy makers have designed social policies in low-income countries based on research that indicates income in the hands of women promotes household well-being more than when controlled by men (13).

Most relevant to this study, research on cash cropping in Africa reveals that food availability and dietary energy adequacy are better in female-headed households compared with male-headed households (14, 15). Another study, of married mothers in the Philippines, suggests that mothers' access to and control over household income increases household spending on food (16). A recent study also indicates low maternal education is associated with household food insecurity in rural Honduras (17), and in rural Tanzania households have higher seasonal food insecurity when mothers report less social support (3). Together these studies suggest the potentially important role of maternal economic and social resources for preventing household food insecurity, but no study to date has assessed associations between household food insecurity and multiple aspects of mothers' economic and social resources, net of household economic status and demographics.

Also lacking is research on whether maternal resources affect adult- and child-specific food insecurity. There is some evidence that children are buffered from food insecurity more than adults (11, 18, 19), and that household socio-economic status may protect children more than adults from food insecurity (20). Given research that indicates women use household resources to protect child well-being more than men do (16, 21, 22), maternal resources may be particularly important for reducing food insecurity among children. However, we were unable to find studies assessing maternal resource effects on adult- and child-specific food insecurity in any setting.

This study addresses these research gaps, increasing our understanding of how multiple types of maternal resources are associated with household and adult/child-specific food insecurity in urban and rural areas of León, Nicaragua.

Nicaragua

Across multiple indicators, Nicaragua is characterized as one of the poorest countries in Latin America with 45% of the population living on less than $1/day (23). Reports from aid agencies state that "food insecurity is one of the most critical development challenges facing Nicaragua" (23); and, that this is due to lack of access to affordable food rather than low food availability. Most recently, the "Global Food Crisis" (2006-2008) and on-going fluctuations in global markets continue to increase the cost of and instability in prices of basic food goods in Nicaragua (24). As a result, it is estimated that almost 30% of the Nicaraguan population is under-nourished (23), and women and children are most vulnerable to food insecurity and under-nutrition (24).

In addition to high poverty and risks of food insecurity, gender dynamics in Nicaragua make this an important setting for understanding the relationship between maternal access to resources and food insecurity. Gender roles and poverty come together in Nicaragua to reduce women's power and access to economic resources while placing the burden on them to provide for their children. Recent statistics indicate low marriage rates among women (48% legally married), a high proportion of female-headed households (30%), and high female labor force participation (48%) compared to other patriarchal countries in Latin America like Mexico (25).

Study Hypotheses

In this setting, and following past research, we hypothesize that household food insecurity will be lower when mothers have higher levels of economic and social resources. We measure mothers' economic resources through their reported contributions to household income and role in managing household income. Social resources include maternal level of education, union status, and reported

social support. We expect lower household food insecurity when mothers contribute more economically to the household and have greater control over managing household financial resources. Higher maternal education is expected to be associated with lower food insecurity due to research demonstrating mothers with higher education have more social and human capital that can be used to benefit child well-being (26) and reduce household food insecurity (17). Married and cohabiting mothers are hypothesized to have higher household food security than those without a partner due to the financial, emotional, time and other key resources that may be provided by partners. Maternal social support is expected to be negatively associated with household food insecurity by providing sources of help in difficult times (3). We further hypothesize that these maternal resources may be more important for reducing food insecurity among children than among adults, given the role of mothers as primary care takers in Nicaragua and past research suggesting that children are protected from food insecurity more than adults in poor households (20).

Methods

Study Design

This study was designed to increase our knowledge of the relationships among maternal resources, poverty, and food insecurity in households with children. Our research centers around the household as a key institution where individuals purchase, produce, prepare, distribute, and consume food on a daily basis. Young children are particularly dependent on household resources and food for adequate nutrition, making this an important population within which to understand food insecurity. The target population for this study was households with at least one child who was not breastfeeding but still highly dependent on the household for food (i.e., between the ages of 3 and 10).

The municipality of Leon was selected as the study site due to the ongoing Health and Demographic Surveillance System (HDSS) León, which provided a sampling frame and local collaborators for the study. León is the second largest municipality (~180,000) in Nicaragua and is 70% urban. Although 40% of the urban population lives in poverty, poverty is more severe and common in the rural areas of León, where 70% of residents are poor, land is concentrated in the hands of the elite, and households are further from sources of affordable food (27). Although food insecurity and malnutrition are estimated to be moderate in León compared to other municipalities in the country (28), León bears the legacy of the cotton agro-industry, which boomed and then busted in the 1990s, leaving many rural farmers landless and urban laborers unemployed. There is little remaining tradition of growing one's own food in León,

which is substantiated by our data that indicate 92% of household food is purchased (97% in urban and 84% in rural areas).

Study Sample

The study sample was selected from the HDSS-León, a representative sample of over 10,000 households in the municipality of León that has been collected by the Center for Health and Demographic Research (CIDS) at the National Autonomous University of Nicaragua – León (UNAN–León) since 1993 (29). In 2009, the HDSS sample was refreshed to reflect the current population of the municipality. In collaboration with statisticians from CIDS a power analysis was conducted estimating levels of food insecurity at 50% and an error rate of 5%. An additional 10% was added to account for the cluster design effect and 15% for potential non-response. This yielded a target sample of 500 households. We randomly selected households from the HDSS who had children between the ages of 0 and 8 years in 2009, and would thus be in our target population of households with a child aged 3-10 years in 2012. This process was conducted separately for rural and urban samples, with urban defined as the administrative boundaries used in the original HDSS sample. Because the city has grown since the baseline survey, we oversampled rural households (n=200) to ensure we would have an adequate number of rural households that were not part of the overgrowth of the urban center. The study response rate was high (94%), resulting in a loss of only 30 households. In an additional 27 households mothers were absent; these households were not included in the analytical sample (N=443).

Data Collection

Over a three-week period, Ohio State University researchers worked with CIDS researchers to select and train 10 local women who made up five interview teams, each consisting of one nurse and one social worker. The women were trained in research ethics, the collection of anthropometric and anemia biomeasures, and the administration of the questionnaire. As the interviewers were all local women, their advice was sought in the wording of questions and their suggestions integrated into the final version of the survey instrument. The data entry personnel and field coordinators were also included in these trainings and were further trained in quality control of the completed surveys and data entry. Once the quantitative survey instrument was finalized, it was validated and field tested in randomly-selected households outside of the study sample but within the study area.

The final questionnaire was administered to the sample households with mothers as the respondents. If the mother was permanently absent an alternate respondent was used. This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving human

subjects were approved by the Institutional Review Boards at The Ohio State University and at the National Autonomous University of Nicaragua - León (UNAN - León). Verbal informed consent was witnessed and formally recorded for all subjects. During the course of the interview, interviewees were reminded of their right to refuse to respond to any study question or terminate the interview. Interviewers returned to households as needed to complete the interviews and ensure high quality data. Throughout the data collection process quality control was ensured through supervision by coordinators both in the field and in the data entry process.

Measures: Dependent Variables

Household food insecurity was assessed through the recently-validated Nicaraguan version of the Latin American Food Security Questionnaire (ELCSA), which consists of 15 questions related to concerns with and household experiences of food scarcity due to lack of sufficient money or resources during the past three months. The original perceived household food insecurity questionnaire was developed in the U.S. (30) and subsequently adapted internationally. The Latin American version (ELCSA), validated across the region as a reliable indicator of perceived food security (31-33), was field tested and adapted for use in Nicaragua. Three dependent variables were created from the ELCSA: (1) *household* food insecurity, measured by the number of affirmative responses to the 15 questions; (2) *adult* food insecurity, measured by the number of affirmative responses to five adult-oriented questions; and, (3) *child* (<18 years) food insecurity measured by the number of affirmative responses to seven child-oriented questions. Following existing research, household food insecurity was converted to a dichotomous measure with fewer than 6 affirmative responses indicating mild or no food insecurity and 6 or greater affirmative responses indicating moderate to severe food insecurity (FAO, 2012). Given the lack of research separating out the adult- and child-specific questions in developing countries, no established cut off has been set. These measures were considered as continuous outcomes to capture variation in the level of adult and child-specific food insecurity.

Measures: Independent Variables

Maternal resources were assessed through five measures: two measures of economic resources and three measures of social resources. The first maternal economic resource variable measured who contributed the most money to the household – the mother alone, spouse/partner alone, mother equally with spouse/partner, or another person. This variable was collapsed into a 3-category variable indicating households where the mother contributed the most or equal to their spouse, the spouse contributed the most, or some other person contributed the most to household income. The second maternal economic

variable assessed who usually manages household money – the mother alone, mother equally with her spouse, spouse alone, or some other household member. A dummy variable was created to reflect households where mothers had full control or equally shared control with their spouse (=1), compared with those where mothers had little role in managing household money.

Three variables were used to capture maternal social resources: maternal education, maternal union status, and maternal-reported social support. Education was categorized as primary level or less, secondary, more than high school. Maternal union status was categorized as married, cohabiting (residential, unmarried partner), or no partner (including never-married, separated, divorced and widowed mothers). Further disaggregation of the "no partner" category did not change the results. Level of maternal social support was evaluated through 13 questions. The first seven asked about instrumental support; such as, whether the mother had someone from whom she could obtain help when needed (e.g., borrow money, give food, take care of children, help with housework, etc.). The other six related to whether the mother had someone who supported her emotionally (e.g., listened to her, relaxed with her, gave her advice, etc.). Affirmative answers were summed and the variable was used as a continuous measure of social support ranging from 0 to 13.

To consider the importance of maternal resources net of household resources, four measures of household economic resources were included: a wealth index, access to land, receipt of migration remittances, and receipt of government cash assistance. The household wealth index was calculated using principal component analysis, integrating measures of household assets, housing quality, water availability, and type of sanitation into a score for each household. The first wealth component score (eigenvalue >3) was included as the household wealth measure. This method has been shown to be an efficient way to control for economic status in developing country households (34). Access to land was measured as a dummy variable indicating if the household had land that could be used for crops or animal pasture. Migration remittances were defined as economic help given to the household in the past six months by family members or friends living outside of León or Nicaragua and measured as a yes/no dummy variable. Government cash assistance received regularly by any household member was coded as a dummy variable.

Control variables included: maternal age, mother currently pregnant, grandparents living in the household, age of the youngest child, and number of children in the household. We also included urban/rural and community dummy variables defined by administrative boundaries. The community dummy variables indicated in which of the three areas of León the household was located: Sutiaba (30%

of sample households), Perla (41% of sample), and Mántica (29% sample). The community dummy variables controlled for unobserved differences among the 3 communities that may affect both mothers' access to resources and household food insecurity.

Statistical Analysis

The household food insecurity models used a dichotomous dependent variable (moderate/severe household food insecurity) and were estimated with multivariate logistic regression. The results are presented as odds ratios (exponentiated coefficients). For the adult and child-specific models, the dependent variables are count data that are over-dispersed, requiring negative binomial regression analysis (35). Models were estimated using maximum likelihood and the results are presented as incidence risk ratios (exponentiated coefficients). Standard errors were corrected for clustering among household within each community, and confidence intervals are shown in the tables. Statistical significance of all variables was assessed through two-tailed z-tests of $p<0.05$.

Results

Table 1 presents summary results of the levels of perceived household food insecurity. The mean number of affirmative responses was four (with substantial variation) and twenty-seven percent of the sample was moderately to severely food insecure (see Table 1). Sixty-seven percent reported worrying that food would run out and 26% reported running out of food in the past three months (not shown in table). The adult and child-specific questions reflect the strategies used to cope with low food availability. The mean score for both adult and child food insecurity was one (see Table 1). Despite these low averages, 36% of households reported that an adult ate less than they should have; and, 26% that an adult was hungry but did not eat at least once in the past three months due to insufficient money to purchase food (not shown in table). The most common child experiences were decreasing the amount of food served to a child (24%), children having little dietary diversity (22%), and a child eating less than they should have (20%). Eleven percent of households reported that a child skipped a meal or felt hungry but did not eat, and 6% reported that a child had gone a whole day without eating at least once in the past three months. Rural households had significantly higher mean household, adult and child food insecurity scores than urban households.

[Insert Table 1 here.]

Table 2 provides descriptive statistics for our independent variables of interest and control variables. Although over half of the sample mothers worked for pay, only 34% of the mothers contributed as much or more than their spouse to household income (19% of mothers reported contributing more to

household income than their spouse or other member). Despite their relatively low economic contributions, in the majority of households (72%) mothers played a significant role in managing household economic resources: 58% reported being the primary money managers and 14% reported managing household money equally with their spouse/partner. Mothers in our sample had mixed access to social resources: they reported relatively low education (37% primary or below) and high rates of single motherhood (21% of the sample), but high social support (an average of 10 points out of a possible 13). In terms of household economic status, households averaged 9 of 17 possible household assets (median=9), relatively few had access to land (18%), 14% received remittances in the past 6 months, and only 4% received regular cash support from the government.

[Insert Table 2 here.]

Table 3 reports the results of regression models estimating the associations between maternal resources and a dichotomous measure of moderate to severe household food insecurity. All results are presented as odds ratios, with ratios below one indicating a decrease and above one an increase in food insecurity. Models are shown first with the basic control and household economic variables traditionally associated with food insecurity, followed by models incorporating the maternal resource measures.

Model 1 indicates a significantly higher odds of food insecurity in rural compared with urban households, even when controlling for household demographics and community fixed effects. However, this difference disappears when household economic status is taken into account (Model 2). Not surprisingly, higher household wealth and receipt of remittances were associated with lower odds of household food insecurity (Table 3, Model 2).

[Insert Table 3 here.]

Model 3 shows the associations between maternal economic and social resources and household food insecurity controlling for household economic resources, demographics, and community effects. Compared to households where spouses alone provided the main source of income, households where the mother contributed equally to or more than their spouse had a 34% lower risk of moderate/severe food insecurity. Households where mothers managed household money by themselves or equally with their spouses had a 60% lower risk of moderate/severe food insecurity compared with households where the spouse or other member manages the household money (Table 3, Model 3). In terms of social resources, maternal education, married or cohabiting union status and social support were all associated with lower odds of household food insecurity net of household economic status, demographics, and community control variables. For example, households where mothers had a secondary education had

47% lower odds of moderate/severe household food insecurity than households where maternal education was low (primary or below). Households with married or cohabiting mothers had 35% and 36% lower odds of being moderately/severely food insecure, compared to single mother households. Finally, each point increase in maternal social support was associated with 16% lower odds of moderate/severe household food insecurity (see Table 3, Model 3).

Table 4 shows the results (presented as incidence rate ratios) of the adult and child food insecurity models. Maternal economic contribution to the household was important for both adult and child food security, reducing the insecurity rates by 29% for adults and 36% for children, compared with households where the spouse was the main breadwinner. Having household money managed by the mother was also important, but only for reducing the incidence rate of adult food insecurity; it decreased the rate by 36% compared with households where the spouse or other household member was the main money manager. Among the maternal social resource variables, above primary maternal education was associated with significantly lower incidence of adult and child food insecurity compared to households with low maternal education (see Table 4). Although maternal union status had similar sized effects on adult and child food insecurity, the associations were not statistically significant in the child model (Model 2). Maternal social support was significantly associated with lower incidence of food insecurity for both adults and children (Table 4, Models 1 & 2).

[Insert Table 4 here.]

The findings in Table 4 indicate significant associations between household economic status and adult and child-specific food insecurity; household wealth, access to land and receipt of remittances significantly reduced the incidence of adult and child food insecurity. Although it appears government support was associated with adult food insecurity, this result should be viewed with caution given the low percent of households receiving cash assistance (4%). In sum, comparing Models 1 & 2, the overall pattern of associations between maternal resources, household economic resources, adult and child food insecurity is similar. However, it should be noted that the model fit, indicated by the log likelihood, is better for the child-specific than adult-specific models (lower negative number at the bottom of Table 4).

Discussion

Our study aimed to assess the importance of maternal resources for reducing household food insecurity in households with children in León, Nicaragua. Despite León's location in the central pacific region, where food insecurity is estimated to be lower than in other areas of Nicaragua (28), we found that the majority (76%) of our sample households were food insecure and 27% reported

moderate/severe food insecurity. It is important to note that these data were collected during a period of political, economic and environmental stability. Rates are likely to be higher with international food price increases, during agricultural droughts, following natural disasters, or under other conditions of political and economic upheaval.

This study empirically tested whether maternal economic and social resources are important determinants of household food insecurity, net of household economic status, demographic characteristics and community differences. Maternal measures included more typical social status indicators (maternal education, maternal union status), as well as less-studied indicators of mothers' access to and control over resources (contribution to household earnings, control over household economic resources) and extent of social support. We also considered adult and child food security separately to assess whether maternal resources mattered more for protecting children from food insecurity.

Our results suggest that mothers' larger economic contribution to household income was associated with lower household food insecurity. This is consistent with literature that finds mothers may gain respect and power within the household, and children have better nutritional status, when mothers make a substantial contribution to household income (36). Maternal control over household spending significantly decreased the risk of moderate/severe household food insecurity. This suggests that women's ability to direct household spending, regardless of who earns it, may affect household food security. This finding is in agreement with research that indicates women's control over spending household income increases spending on food in households with children (16).

Findings regarding social resources indicated that higher maternal education was associated with lower food insecurity, consistent with the recent study in rural Honduras (17). It is important to note that we tested models using the household head's education and found no significant association with food insecurity. Because the household head's education is correlated with maternal education, it is difficult to estimate both in the same model, but the lack of significance of the household head's education in separate models suggests that maternal education, not the general social status of the household, matters for food insecurity. The odds of moderate or severe household food insecurity also was lower in married and cohabiting than single-mother households. Given controls for economic status, this suggests that the presence of a partner may help with food security in non-economic ways: by providing time, information and other important resources for securing food.

Finally, greater maternal social support was consistently associated with reduced odds of moderate or severe household food insecurity. Although some evidence from Tanzania supports this link between social support and food insecurity (3), we know of no other study that assessed maternal social support and food insecurity in a Latin American setting. It should be noted, that food insecurity can disrupt social interactions and lead to social isolation (37). This implies a potentially reciprocal relationship between maternal social support and household food insecurity that needs to be further explicated with longitudinal data.

The results from the adult and child-specific food insecurity models also show that maternal resources are associated with reports of reduced quality and/or quantity of individuals' food intake. Maternal economic contribution, management of household money, higher education, and having a marital partner in the home all contributed to lower risk of food insecurity among adults in the household. All maternal resources, except mothers' control over household spending and maternal union status, were associated with reduced child-specific food insecurity. Maternal control over household spending may not be as important for child food security if children are generally protected from food restrictions by mothers through strategies other than managing household economic resources. The lack of a union status effect in the child-specific models may indicate that single and partnered mothers are equally able to protect children from food insecurity if given access to other key resources (education, social support, and income), or that they are more likely to sacrifice their own (or other adults') food intake to buffer their children from food insecurity.

Several study limitations should be considered. First, the data are cross-sectional, reducing our ability to make causal inferences or assess the dynamics of household food insecurity over time and across seasons. Second, our measure of household food insecurity, although validated across settings, is limited by its design as a measure perceived household food insecurity. This measure does not reflect actual intake or food availability. Past studies, however, have found significant correlation between this measure and the variety of foods consumed at the household level (38). Third, our sample consists of households with young children in León, and thus the results cannot be generalized to all households in Nicaragua. However, this sample represents a group of policy interest – households with children in a high poverty setting – and the findings can inform efforts to improve food insecurity in similarly vulnerable households within Nicaragua.

Despite these limitations, this study informs the growing body of food insecurity literature by providing new empirical evidence supporting theories that mothers' access to resources is critical to

reducing household food insecurity in households with children. The significant associations of maternal social and economic resources with reduced food insecurity suggest that both women's reproductive/care and productive/work roles are important to address in reducing household food insecurity. As data become available, future research should focus on comparative studies across the Latin American region, where we know relatively little about the dynamics of food insecurity, and longitudinal studies of maternal resources and food insecurity over time.

Policy efforts to improve food insecurity in poor settings, such as León, should consider multiple strategies that improve women's access to and control over household economic resources. Such policies may include directing food aid to mothers rather than schools or households and cash assistance given to mothers. Although a conditional cash transfer program, *Red de Protección Social*, is in place, this program was not highly prevalent in our sample households, perhaps due to its limited geographic scope and fixed three year enrollment period (39). Labor market policies, such as educational investments (particularly for girls and women), higher minimum wages, and child care support targeted at helping women enter and stay in the labor market, could be used to increase mothers' access to economic resources. These policies that promote investments in women may reduce household food insecurity more than policies that support traditional male-breadwinner families. Promoting social connections among mothers through neighborhood, church, or other social support groups may also help protect households from food insecurity. Finally, understanding food insecurity and the dynamics in unmarried mother households will be a critical area for future research in Nicaragua, and elsewhere, given the rising rates of single mothers and female-headed households in the developing world (40).

Tables and Figures

Table 1: Perceived household food insecurity in past three months. N=443

Continuous Food Insecurity Measures	Mean	S.D.	Min	Max
Total affirmative responses	3.61	4.15	0	15
Total adult score	1.28	1.72	0	5
Total child score	1.10	1.91	0	7
Categorical Food Insecurity Measures			%	
Household secure (0 affirmative responses)			24%	
Household mildly insecure (1-5 affirmative responses)			49%	
Moderate or severe (>5 affirmative responses)			27%	

Table 2. Description of study sample (N = 443 households)

Variable	Mean/%	S.D.	Min	Max
Maternal Economic Resources				
Mother contributes most to HH income (self or equally with spouse)	34%			
Spouse alone contributes most to HH income	49%			
Other person contributes most to HH income	17%			
Mother manages household money (self or equally with spouse)	72%			
Maternal Social Resources				
Mother primary education or less	37%			
Mother secondary education	43%			
Mother higher than sec. educ.	20%			
Mother married	42%			
Mother cohabiting	38%			
Mother single	21%			
Total social support (# affirmative responses)	10.3	2.87	0	13
Household Economic Resources				
Number of household assets[1]	9.1	3.10	0	17
Access to land for crops/pasture	18%			
Received remittances (past 6 mo.)	14%			
Receives gov. cash assistance	4%			
Demographic Characteristics				
Maternal age	31.3	6.75	18	61
Mother pregnant	3%	0.18	0	1
No grandparents in household	49%			
Age of youngest child in household	3.9	2.64	0	10
Number children in household	3.2	1.68	1	14
Urban	60%			

[1]Wealth index (principal components score of assets, housing quality, sanitation, and animals) rather than number of assets used in regression analysis.

Table 3: Logistic Regression Results: Associations between Maternal Resources and Moderate/Severe Household Food Insecurity. Odds Ratios presented. N=443

	Model 1		Model 2		Model 3	
Independent Variables	OR	95% CI	OR	95% CI	OR	95% CI
Maternal Economic Resources						
Mother contributes most to household income[1]					0.66**	(0.55 - 0.80)
Other person contributes most to household income[1]					0.99	(0.23 - 4.23)
Mother manages household income[2]					0.40**	(0.24 - 0.66)
Maternal Social Resources						
Secondary education[3]					0.53*	(0.31 - 0.90)
Higher education[3]					0.62*	(0.40 - 0.96)
Married[4]					0.65*	(0.45 - 0.93)
Cohabiting[4]					0.64*	(0.42 -0.98)
Social support					0.84**	(0.83 - 0.85)
Household economic resources						
Wealth score			0.67**	(0.57 - 0.80)	0.71**	(0.62 - 0.82)
Access to crop/pasture land			0.56	(0.20 - 1.55)	0.52	(0.19 - 1.43)
Received remittances			0.35**	(0.21 - 0.58)	0.36	(0.13 - 1.00)
Receives gov. cash support			0.72	(0.44 - 1.17)	1.36	(0.97 - 1.90)
Controls						
Maternal age	0.98*	(0.97 - 1.00)	0.99**	(0.98 - 1.00)	0.99	(0.98 - 1.01)
Mother pregnant	0.66	(0.28 - 1.52)	0.84	(0.29 - 2.47)	0.78	(0.12 - 5.17)
No grandparents in household	1.64**	(1.27 - 2.12)	1.30	(0.81 - 2.11)	1.38	(0.93 - 2.05)
Age of youngest child	1.02	(0.90 - 1.16)	1.05	(0.92 - 1.19)	1.07	(0.99 - 1.16)
# children in household	1.21**	(1.12 - 1.32)	1.16**	(1.10 - 1.22)	1.19	(0.98 - 1.44)
Urban area	0.29**	(0.17 - 0.50)	0.95	(0.65 - 1.40)	0.69	(0.33 - 1.44)
Sutiaba community[5]	2.84**	(2.20 - 3.67)	2.47**	(1.96 - 3.12)	2.88**	(1.95 - 4.25)
Perla community[5]	1.76**	(1.75 - 1.77)	1.98**	(1.82 - 2.15)	2.02**	(1.72 - 2.37)

Constant	0.26** (0.12 - 0.59)	0.13** (0.067 - 0.26)	2.60** (1.74 - 3.89)
Log likelihood	-234	-218	-198

** p<0.01, * p<0.05.

[1]Spouse alone contributes most $ to household; [2]Spouse or other person manages household money; [3]Ref group: primary education or less; [4]Ref group: single, divorced, separated or widowed; [5]Ref group: Mántica community.

Table 4: Negative Binomial Regression Results: Associations between Maternal Resources and Adult and Child Food Insecurity. Incidence Rate Ratios presented. N=443

	Adult food insecurity		Child food insecurity	
Independent Variables	IRR	95% CI	IRR	95% CI
Maternal Economic Resources				
Mother contributes most to household income[1]	0.72**	(0.65 - 0.79)	0.64**	(0.59 - 0.69)
Other person contributes most to household income[1]	0.83	(0.48 - 1.41)	0.88	(0.41 - 1.86)
Mother manages household income[2]	0.64**	(0.48 - 0.86)	0.70	(0.42 - 1.15)
Maternal Social Resources				
Secondary education[3]	0.66**	(0.51 - 0.86)	0.66**	(0.59 - 0.75)
Higher education[3]	0.64**	(0.55 - 0.75)	0.49**	(0.36 - 0.65)
Married[4]	0.80*	(0.66 - 0.96)	0.83	(0.67 - 1.04)
Cohabiting[4]	0.85	(0.71 - 1.02)	0.76	(0.51 - 1.12)
Social support	0.90**	(0.86 - 0.93)	0.89**	(0.86 - 0.92)
Household economic resources				
Wealth score	0.83**	(0.74 - 0.92)	0.77**	(0.67 - 0.88)
Access to crop/pasture land	0.62*	(0.43 - 0.91)	0.54**	(0.37 - 0.79)
Received remittances	0.69**	(0.53 - 0.90)	0.56*	(0.33 - 0.93)
Receives gov. cash support	0.66*	(0.47 - 0.92)	1.01	(0.58 - 1.76)
Controls				
Maternal age	0.99	(0.98 - 1.01)	1.01	(0.96 - 1.06)
Mother pregnant	1.54**	(1.36 - 1.74)	1.34	(0.68 - 2.64)
No grandparents in household	0.85	(0.57 - 1.26)	0.92	(0.47 - 1.79)
Age of youngest child	1.04*	(1.00 - 1.09)	1.07	(1.00 - 1.14)
# children in household	1.12**	(1.06 - 1.18)	1.12	(0.99 - 1.28)
Urban area	0.90*	(0.81 - 0.99)	0.79	(0.46 - 1.35)
Sutiaba community[5]	1.75**	(1.36 - 2.25)	1.98**	(1.50 - 2.62)
Perla community[5]	1.73**	(1.39 - 2.17)	2.02**	(1.47 - 2.76)
Constant	4.64**	(3.62 - 5.95)	2.13	(0.50 - 9.06)

Log likelihood	-626	-548

** p<0.01, * p<0.05.

[1]Spouse alone contributes most $ to household; [2]Spouse or other person manages household money; [3]Ref group: primary education or less; [4]Ref group: single, divorced, separated or widowed; [5]Ref group: Mántica community.

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