

Malnutrition in Mesoamerica:
The distribution and correlates of stunting, wasting,
underweight, and anemia

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ABSTRACT

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Background: In 2013, 1.5 million deaths attributable to malnutrition occurred globally to children younger than 5 years. Childhood malnutrition is strongly linked to child mortality, disease, and educational and later-life economic success. Latin America is a highly inequitable region that has seen a slowing rate of decline in undernutrition in the past two decades, while facing a high burden of chronic malnutrition. The aims of this analysis were to measure the prevalence of growth attainment and anemia indicators in the poorest quintile of the population in Mesoamerica, and to identify characteristics associated with those conditions.

Methods: Data for this analysis came from the Salud Mesoamérica 2015 Initiative (SM2015) baseline evaluation. Data was collected from 23,005 children age 0-59 months in the poorest quintile of the population in each of El Salvador, Guatemala, Honduras, Nicaragua, Panama, and the State of Chiapas, Mexico. Trained anthropometrists performed height and weight measurements for 20,730 children and finger prick anemia tests on 16,964 children age 0-59 months. Child growth was age-sex standardized to measure the prevalence of stunting, wasting, underweight, overweight, and anemia. Logistic regressions were conducted to determine the individual, maternal, and household characteristics associated with each growth and anemia outcome. Survey weights were used to account for survey design.

Findings: Anemia and stunting are the most common undernutrition problems in the region. Anemia ranges from 20.1% (Nicaragua) to 55.0% (Guatemala), and stunting from 16.9% (El Salvador) to 58.5% (Guatemala). There is very low wasting prevalence (0.7% in Honduras to 2.4% in El Salvador), and most countries had more children overweight than underweight. Within countries, there is significant geographic variation in the prevalence of these outcomes by department. Socioeconomic characteristics including household wealth and maternal education are associated with stunting. Children in urban areas are less likely to be stunted (OR=0.70, 95% CI: 0.56-0.87) or anemic (OR=0.75, 95% CI: 0.61-0.94). Children who were born at low birth weight are more likely to be stunted (OR=1.62, 95% CI: 1.28-2.06), severely stunted (OR=1.55, 95% CI: 1.10-2.19), wasted (OR=2.23, 95% CI: 1.24-4.00), and underweight (OR=2.71, 95% CI: 1.94-3.80). Recent illness is associated with higher likelihood of anemia (OR=1.26, 95% CI: 1.13-1.51) and underweight (OR=1.36, 95% CI: 1.07-1.73).

Conclusions: Recent improvements in undernutrition in the Mesoamerican region mask the high burden of chronic undernutrition affecting the poorest areas. Despite presence of fortified foods and dietary supplementation programs, children in these areas are still not meeting growth potential. These findings can be used to better target at-risk children, families, and communities.

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INTRODUCTION

It is estimated that in 2013, 1.5 million deaths occurred worldwide among children under 5 years of age that can be attributed to undernutrition, almost exclusively in developing countries. This is 23.8% of all deaths in this age group¹. Although Central Latin America has reduced child mortality rates in the last two decades as part of Millennium Development Goal 4 (MDG 4), half of countries in the region saw slower rates of decline after 2000 than from 1990-2000². Malnutrition is a preventable cause of death, and the reduction of childhood undernutrition could reduce child mortality rates and rates of infection, and could improve the educational and economic success of those children in later life³.

MDG 1 aims to eradicate extreme poverty and hunger, and includes targets for reducing the proportion of children that are underweight⁴. Underweight is typically caused by a combination of acute and chronic malnutrition, leading a child to be small for his or her age. The Latin America and Caribbean region is among the fastest-improving regions towards the reduction of underweight prevalence. By contrast, the region has exhibited a slower reduction in the prevalence of stunting⁵. It is the most prevalent growth problem and is particularly common in Guatemala⁵⁻⁷. Stunted children are short for their age; this is caused by chronic malnutrition and is not reversible. Acute, severe malnutrition manifests as wasting, and is strongly associated with child mortality. Standardized growth curves and definitions for these growth indicators have been developed by the World Health Organization (WHO)⁸. Underweight children are two or more standard deviations (SD) below the mean weight-for-age on a standardized growth curve. Stunted children are two or more SD below the mean height-for-age. Wasted children are two or more SD below the mean weight-for-height.

Another indicator of malnutrition is anemia, which occurs when there is a decreased quantity of red blood cells, usually coexisting with decreased hemoglobin levels or altered red blood cell morphology such as sickle cell disease⁹. Iron-deficiency anemia was the leading cause of years of life lost to disability (YLD) in children under age 5 years in Central Latin America in 2010. It contributed 33.7% of total YLDs—twice as much as diarrheal disease¹⁰. Anemia also increases risk of child mortality. A recent meta-analysis indicated that the odds ratio of child mortality associated with a 1 g/dL increase in hemoglobin concentration is 0.826 (95% confidence interval [CI]: 0.790-0.864)¹¹. Anemia has many causes, including iron deficiency and infections like hookworm disease. Measurement of hemoglobin concentration provides evidence of anemia, but does not identify the cause. However, it is estimated that iron deficiency is the cause of half of all anemia cases in Central Latin America^{9,12}.

Stunting, underweight, wasting, and anemia have complex direct and indirect causes. A framework developed by UNICEF identifies causes of undernutrition in mothers and children (Appendix Figure A1)¹³. Poverty and food insecurity are tightly linked with undernutrition and disease incidence. Poor children and families are likely to have worse health care access and health knowledge, thus leaving them at higher risk for undernutrition and limiting life course health and success^{3,14}. There is a strong intergenerational effect on growth that is both biological and socio-cultural¹⁴. Persisting malnutrition is a road block for economic development³.

Mesoamerica, the region from southern Mexico to Panama, is undergoing the epidemiologic transition, facing slowly declining rates of infectious diseases and undernutrition coupled with rising prevalence of chronic diseases and obesity¹⁵. This has led to concurrent burdens of overweight with stunting, wasting, and anemia. Given evidence of a double-burden, it is likely the experience differs greatly for children in poor areas compared to those in wealthy,

urban communities. In fact, Mesoamerica is one of the most inequitable regions in the world. Regional improvements in health mask the great disparity between the extremely poor and the general population¹⁶. In Mesoamerica, it is estimated that underweight prevalence is four times higher among the poorest quintile compared to the wealthiest¹⁶. In Mexico, the prevalence of underweight and stunting is about two times higher among indigenous children than non-indigenous in rural areas, and three times higher in urban areas¹⁷.

There exist effective health behavior and nutritional interventions for prevention and treatment of undernutrition¹³. In Latin America, most countries have nutritional interventions, including availability of macro- and micronutrient supplements and fortified grains. However, there is often lower coverage and uptake among poor and indigenous populations¹⁸. While demographic and health surveys in Mesoamerican countries provide national estimates of anemia and growth, sample sizes are low in poor and indigenous areas of these countries. Thus, there is a gap in available evidence for these high-risk populations. It is critical to have information about the nutritional status of poor populations in order to target interventions.

The Salud Mesoamérica 2015 Initiative (SM2015) was established to address the health issues faced by the poorest quintile of the population in Belize, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, and Panama. This public-private partnership supports countries in implementing supply- and demand-side interventions to improve the health of poor women and children, make progress towards MDG 4 and 5, and close the inequity gap¹⁶. One important target is reducing maternal and child undernutrition. The initiative seeks to reduce the prevalence of stunting, micronutrient deficiencies, food insecurity and poverty through tailored intervention packages. Independent evaluations at baseline and following each phase of the initiative allow for measurement of prevalence and progress.

This research uses data from the SM2015 baseline evaluation of households, collected between March 2011 and August 2013 in poor areas of El Salvador, Guatemala, Honduras, Nicaragua, Panama, and the State of Chiapas, Mexico. The goals for this analysis are twofold. First, I aim to measure the prevalence of malnutrition-related growth outcomes and anemia in the poorest quintile of the population of six Mesoamerican countries. The second aim is to determine the individual, family, household, and community factors associated with growth and anemia. This would support a body of knowledge identifying at-risk children, which allows better targeting of interventions to improve coverage and increase health impact.

METHODS

Data Source

The data for this analysis come from the SM2015 baseline evaluation of households in Guatemala, Honduras, Nicaragua, Costa Rica, Panama, and the State of Chiapas, Mexico. Data were collected from March 1, 2011 to August 31, 2013. A brief summary of the initiative, sample design, data collection procedures, and survey content follows¹⁹.

The SM2015 baseline evaluation collected data from municipalities representing the poorest quintile of the population in Belize, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, and Panama. In each country, municipalities were identified to receive interventions or to serve as controls. Data collection in Belize and Costa Rica was conducted through convenience sampling and school surveys, respectively, so these countries will be excluded from this analysis.

Surveys were conducted in both households and health facilities in each country. Within the target municipalities, segments of approximately 150 households were identified using the most recent nationally-representative census, which were conducted between 2002 (Guatemala)

and 2011 (Honduras). We conducted our own censuses within each selected primary sampling unit, a segment, in order to identify eligible households with women ages 15-49 years or children 0-59 months old. Among eligible households, a randomly selected subset was chosen for the household survey.

The household survey had three components. A household questionnaire captured information on assets, wealth, and characteristics of the home. A maternal health questionnaire collected demographic, health behavior, and reproductive health information on women of reproductive age (15-49 years). A child health questionnaire on health, diet, and vaccination history was completed for children aged 0-59 months. Physical measurements and anemia tests were conducted for children using standardized anthropometric and clinical guidelines.

The SM2015 surveys were conducted using a computer-assisted personal interview by trained interviewers. Data was continuously monitored by analysts at the Institute for Health Metrics and Evaluation (IHME) for quality. All data were collected after obtaining written informed consent. The study received institutional review board approval from the University of Washington, partnering data collection agencies, and the Ministry of Health in each country.

Indicators of Anemia and Growth

Child's age was captured in months at the time of the household census. Height (measured in centimeters), weight (kilograms), and blood hemoglobin levels (g/dL) were measured by trained anthropometrists following caregiver consent. Altitude of the locality was measured at the time of the survey using an altimeter, or by the data collection agency using local data sources. Altitude was used to produce adjusted hemoglobin concentrations²⁰. A child age 6-59 months with altitude-adjusted hemoglobin below 11 g/dL was considered anemic, and

below 7 g/dL severely anemic¹². Children 0-5 months were excluded from analysis of anemia because the appropriate hemoglobin cutoff for this age group is unresolved⁹.

Height, weight, and age data were used to compute the Z-score standardized measurement of height-for-age, weight-for-age, and weight-for-height using WHO 2006 standards⁸. Data were excluded if a child's Z-score was outside of WHO plausibility recommendations²¹. The frequency of implausible data and the Z-score corresponding to each growth indicator are detailed in Table 1. These bounds resulted in exclusion of 298 children (1.4% of the measured sample), 129 of which were from Guatemala (Appendix Table A1).

Table 1. Growth indicators and the corresponding standardized measurement cutoff, and the cutoffs for implausible standardized growth values.

Growth metric	Plausibility range	Indicator	Cutoff
Weight for height	Lower: -5 Upper: 5	Overweight	Z>2
		Wasting	Z<-2
		Severe wasting	Z<-3
Height for age	Lower: -6 Upper: 6	Stunting	Z<-2
		Severe stunting	Z<-3
Weight for age	Lower: -6 Upper: 5	Underweight	Z<-2
		Severe underweight	Z<-3

Data Analysis

Individual, maternal, and household characteristics potentially associated with growth and anemia were compared between countries and tested for statistical significant difference using chi-squared tests. These characteristics were also compared between children with and without consent, for both the body size measurement consent and for the hemoglobin finger prick consent.

Individual characteristics include age, gender, recent illness, low birth weight, and breastfeeding in early life. Child age and gender were captured in the household census survey. Recent illness was any caregiver-reported sickness of any type in the two weeks prior to the household survey. A child was considered low birth weight if their mother-reported weight was

less than 2.5 kilograms at birth. Exclusive breastfeeding for the first six months of life was calculated based on maternal recall of breastfeeding duration and complementary feeding. Breastfeeding was only used for analysis among children age six months and older.

Maternal characteristics include age, educational attainment, literacy, marital status, parity, and employment. Education was categorized as none, primary schooling or literacy class, and secondary or more education. Women's literacy was measured as whether she could read none, some, or all of a provided sentence. Marital status was captured in the household census survey. Employment was categorized as homemaker, employed with pay, or other (students, retirees, employees without pay, and disabled individuals unable to work).

Household characteristics include household expenditure quintile, asset index score, household size, urbanicity, indigenous status, and whether the head of household was female. Monthly household expenditure quintile was calculated separately by country. Asset index was calculated as the proportion of items that the household owned from a pre-specified list, including items related to cooking, communication, and transportation. Indigenous status in the household was measured as whether anyone in the household spoke an indigenous language. All areas in Panama were rural. Based on the regions in which data was collected, it was assumed that all households in Panama were indigenous, and that no households in El Salvador were indigenous. Very few households in Honduras (<1.0%) reported a household member that spoke an indigenous language. Thus indigenous status was not used in country-specific analyses of El Salvador, Honduras, or Panama.

Statistical Analysis

The prevalence of each growth and anemia indicator was estimated by country in order to produce representative estimates of the SM2015 selected municipalities, indicative of the

prevalence in the poorest areas of each country or state. Due to the high inequity in the region, the survey-weighted prevalence of these outcomes was also calculated at a smaller geographic level—departments, or health jurisdictions in Chiapas, Mexico.

Survey-weighted logistic regressions were performed to determine the association of selected characteristics with a child exhibiting each of the nutritional outcomes of interest. Standard errors accounted for survey design effects. These regressions were conducted for both the pooled sample and country-stratified samples in order to ascertain differences in the correlates of malnutrition between countries. Multivariable regression was not calculated for very rare outcomes (<1.0% prevalence across the SM2015 sample) due to limited statistical power.

An a priori cutoff for missingness was set at 5%; this criteria was met for exclusive breastfeeding and low birth weight. Age and sex of the child and whether the area was urban or rural were non-missing. Among the other variables, missingness of individual-level characteristics ranged from 3.5% (recent illness) to 23.7% (exclusive breastfeeding), missingness of maternal characteristics ranged from 4.2% (occupation, marital status, age) to 4.9% (parity), and missingness of household and community characteristics from 0.4% (asset score and wealth quintile) to 1.5% (indigenous household, female head of household, household size). A multiple imputation approach was used to resolve data missingness for breastfeeding and low birth weight²². Bivariate logistic regressions were used to determine the association between covariates and each outcome. Incidents of perfect correlation (value of -1.0 or 1.0) between a covariate and outcome were identified. In these cases, if the covariate was an ordered categorical variable then adjacent groups were combined when possible; otherwise the covariate was excluded from multivariable regression for that country-outcome. Further assessment of

collinearity of covariates was done in two ways. First, a pairwise correlation coefficient matrix was computed with an a priori cutoff of 0.70 indicating a multicollinearity problem. No correlation coefficients reached this threshold. Second, for each multivariable regression, variance inflation factors (VIF) were calculated with the a priori cutoff of 10 to indicate variable removal from the regression. No variables reached this threshold.

Stata 13.1 (StataCorp LP, College Station, TX), R 3.0 (R Core Team, Vienna, Austria), and ArcMap 10.1 (Environmental Systems Research Institute, Redland, CA) were used for analyses and the production of figures and tables. Estimates were computed using sample weights to account for the complex survey design unless otherwise noted.

RESULTS

The sample size for each country are presented in Table 2. A total of 90,533 households were visited for the SM2015 household census. The household survey was completed for 20,225 households representing 24,614 women and 23,005 children of age eligibility. The response rate for children participating in the household survey ranged from 87% in El Salvador to 99% in Mexico and Nicaragua (Appendix Table A2). Among children who completed the household survey, height or weight body size measurements were taken for 20,730 children (90.1%). The reasons for children being captured in the household survey but not measured were caregiver refusal (55.0%), child being absent from the home for an extended period of time (29.9%), the child being ill (4.2%), or another reason (11.0%) (Appendix Table A3). Children who were less likely to have received consent were from Mexico and Panama; were sick in the past two weeks; had mothers with no education and no literacy; and lived in homes with fewer assets and an indigenous household member (Appendix Table A4). We obtained hemoglobin concentrations

from finger prick for 16,964 children age 6-59 months. If a caregiver did not consent to height and weight measurements, they were not asked to complete a finger prick test. Among children age 6-59 months who did have their body measured, the reasons for not having consent for finger prick hemoglobin test were caregiver refusal (80.9%), insufficient blood (1.5%), problems puncturing the skin (0.5%), or another reason (17.1%) (Appendix Table A5). Children without consent for the blood draw had the same associated factors as those who did not get consent for body measurements in addition to being more likely to come from Guatemala and having larger household size (Appendix Table A6).

Table 2. Sample size for the SM2015 baseline evaluation.

	Census Survey	Household Survey			Child measurements		
Country	Households	Households	Women	Children	Height	Weight	Hemoglobin^a
El Salvador	16,178	3,625	4,730	3,328	3,277	3,277	2,701
Guatemala	20,451	4,420	5,899	5,282	4,743	4,758	3,710
Honduras	15,741	2,971	3,342	3,144	2,881	2,886	2,445
Mexico	24,349	6,988	5,016	6,462	5,779	5,780	5,020
Nicaragua	8,867	2,071	2,823	2,225	2,163	2,161	1,901
Panama	4,947	1,710	2,453	2,253	1,848	1,851	1,187
Total	90,533	20,225	24,614	23,005	20,691	20,713	16,964

^aAmong children 6-59 months

After excluding children with implausible body size measurements and missing covariates of interest, the resulting sample size used for this analysis for height-for-age is 17,954, for weight-for-age is 17,975, for weight-for-height is 17,925, and for anemia is 15,047.

Characteristics of these children, their mothers, and households are detailed in Table 3. There is significant variation in the distribution of most characteristics between countries. Children in Panama and Guatemala tend to come from larger families, and have mothers with less education. Low birth weight appears less than half as prevalent in Panama as El Salvador. One-quarter of households in El Salvador and Nicaragua had a female head of household, but only 7.0% of

households in Mexico were headed by a woman. Most mothers are homemakers (83.6-93.6% by country). Less than half of mothers in Guatemala are literate (37.1%). Approximately one-fifth of children in this analysis are the first-born child. Recent illness among children is common in El Salvador, where 44.2% of children were sick in the previous two weeks. However, all countries had a prevalence of recent illness above 25%.

Table 3. Characteristics of children in the SM2015 baseline evaluation^a.

		El Salvador	Guatemala	Honduras	Mexico	Nicaragua	Panama	P-value	
		N=2,894	N=4,158	N=2,394	N=5,168	N=1,917	N=1,462		
Child characteristics	Female	48.33%	50.27%	50.66%	49.67%	49.95%	52.57%	0.636	
	Age	0-11 months	17.33%	21.96%	20.38%	19.50%	21.32%	21.66%	0.002
		12-23 months	22.81%	22.12%	21.95%	20.74%	22.36%	22.73%	
		24-35 months	21.75%	21.66%	22.18%	20.08%	19.23%	20.81%	
		36-47 months	20.08%	19.56%	19.30%	21.90%	18.93%	21.42%	
		48-59 months	18.03%	14.69%	16.19%	17.78%	18.17%	13.39%	
	Low birth weight	11.58%	5.81%	8.43%	4.78%	9.25%	3.56%	<0.001	
Exclusive breastfeeding for 6 months ^b	61.49%	62.64%	54.65%	40.71%	48.37%	67.75%	<0.001		
Sick in past 2 weeks	44.20%	26.52%	37.76%	29.52%	32.81%	25.48%	<0.001		
Maternal characteristics	Age	15-19 years	10.27%	9.89%	9.41%	8.69%	12.11%	10.85%	0.004
		20-34 years	69.51%	69.92%	69.22%	72.26%	69.91%	65.05%	
		35-49 years	20.22%	20.18%	21.36%	19.05%	17.97%	24.10%	
	Parity	1 child	28.80%	21.23%	25.03%	17.09%	30.79%	13.12%	<0.001
		2-3 children	40.96%	38.59%	41.32%	42.02%	44.73%	40.49%	
		4-5 children	15.95%	20.66%	18.39%	22.61%	15.15%	26.26%	
		6 or more children	14.29%	19.53%	15.26%	18.28%	9.33%	20.13%	
	Marital status	Married or in union	76.53%	88.59%	82.46%	93.40%	78.81%	84.40%	<0.001
		Single	12.57%	7.09%	14.41%	1.39%	15.61%	7.85%	
		Divorced, separated, widowed, other	10.90%	4.33%	3.13%	5.21%	5.58%	7.75%	
Education	None	11.78%	33.08%	8.68%	16.64%	11.82%	15.78%	<0.001	
	Primary	58.04%	51.97%	72.70%	55.76%	50.65%	56.68%		
	Secondary or more	30.18%	14.95%	18.63%	27.60%	37.53%	27.54%		
Literate		75.91%	37.14%	61.14%	56.40%	72.06%	59.35%	<0.001	
Occupational status	Homemaker	89.82%	93.86%	89.80%	93.31%	83.61%	92.58%	<0.001	
	Employed	8.20%	3.71%	7.92%	5.34%	13.91%	5.41%		
	Student, working without pay, other	1.98%	2.43%	2.29%	1.35%	2.48%	2.01%		

Household and community characteristics		1	22.24%	18.83%	23.66%	22.99%	19.70%	21.37%	
	Household expenditure quintile	2	22.07%	20.19%	20.82%	22.00%	20.76%	19.23%	0.404
		3	19.75%	20.11%	18.46%	20.22%	21.43%	18.04%	
		4	18.41%	19.77%	18.47%	18.48%	19.77%	20.40%	
		5	17.54%	21.10%	18.58%	16.32%	18.34%	20.96%	
	Asset index		0.366	-0.232	0.235	0.234	0.231	0.175	
	Household size		3.066	6.695	5.737	6.066	5.806	9.459	<0.001
	Urban		22.43%	15.45%	14.77%	32.97%	32.51%	0.00%	0.022
	Female head of household		24.77%	11.64%	16.85%	6.97%	24.48%	22.91%	<0.001
	Indigenous household		0.00%	74.39%	0.01%	71.59%	15.35%	100.00%	<0.001

^aSurvey-weighted mean or proportion is presented.

^bAmong children 6 months of age and older. Sample sizes are: El Salvador 2,663; Guatemala 3,727; Honduras 2,163; Mexico 4,717; Nicaragua 1,722; and Panama 1,306.

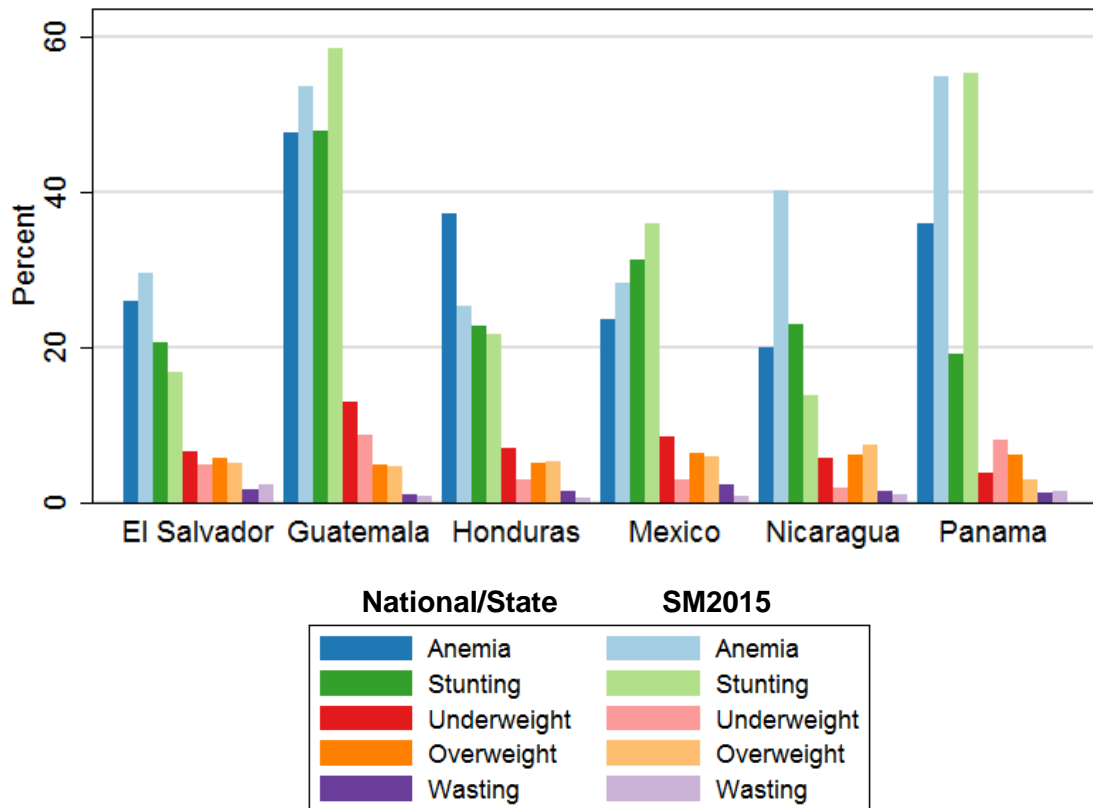
The most common malnutrition-related indicators in the region are anemia and stunting, with a wide range of prevalence between countries (Table 4). There is quite a bit of variation in anemia prevalence between countries in the region, from 20.1% in Nicaragua to 55.0% in Panama. Most countries have more children that are overweight than underweight; the exceptions are Guatemala and Panama. Wasting is rare in the SM2015 population. With the exception of stunting, severe manifestations of these outcomes are rare.

Table 4. Prevalence of growth problems and anemia in SM2015 children (%).

	El Salvador	Guatemala	Honduras	Mexico	Nicaragua	Panama
Anemia	29.6	53.7	25.3	28.3	40.3	55.0
Severe anemia	0.2	0.9	0.8	0.6	1.4	0.5
Overweight	5.2	4.6	5.4	6.0	7.4	2.9
Wasting	2.4	0.9	0.7	0.8	1.0	1.4
Severe wasting	0.6	0.3	0.2	0.2	0.1	0.7
Stunting	16.9	58.5	21.8	36.0	13.9	55.3
Severe stunting	4.3	29.2	6.3	13.1	3.7	21.6
Underweight	4.8	8.7	2.9	3.0	1.9	8.1
Severe underweight	0.7	0.5	0.1	0.1	0.0	0.6

A comparison of SM2015 and recent national or state-level prevalence estimates of growth indicators are presented in Figure 1^{7,18}. Wasting is uncommon in all countries. Nationally, underweight is twice as prevalent as overweight in Guatemala, but these growth indicators are of similar prevalence in other countries. The gaps in anemia prevalence between national and SM2015 populations are large in Nicaragua and Panama. Interestingly, estimates of anemia in Honduras nationally are higher than are observed for the SM2015 population. In Panama, stunting prevalence is more than twice as common for the SM2015 population compared to national estimates.

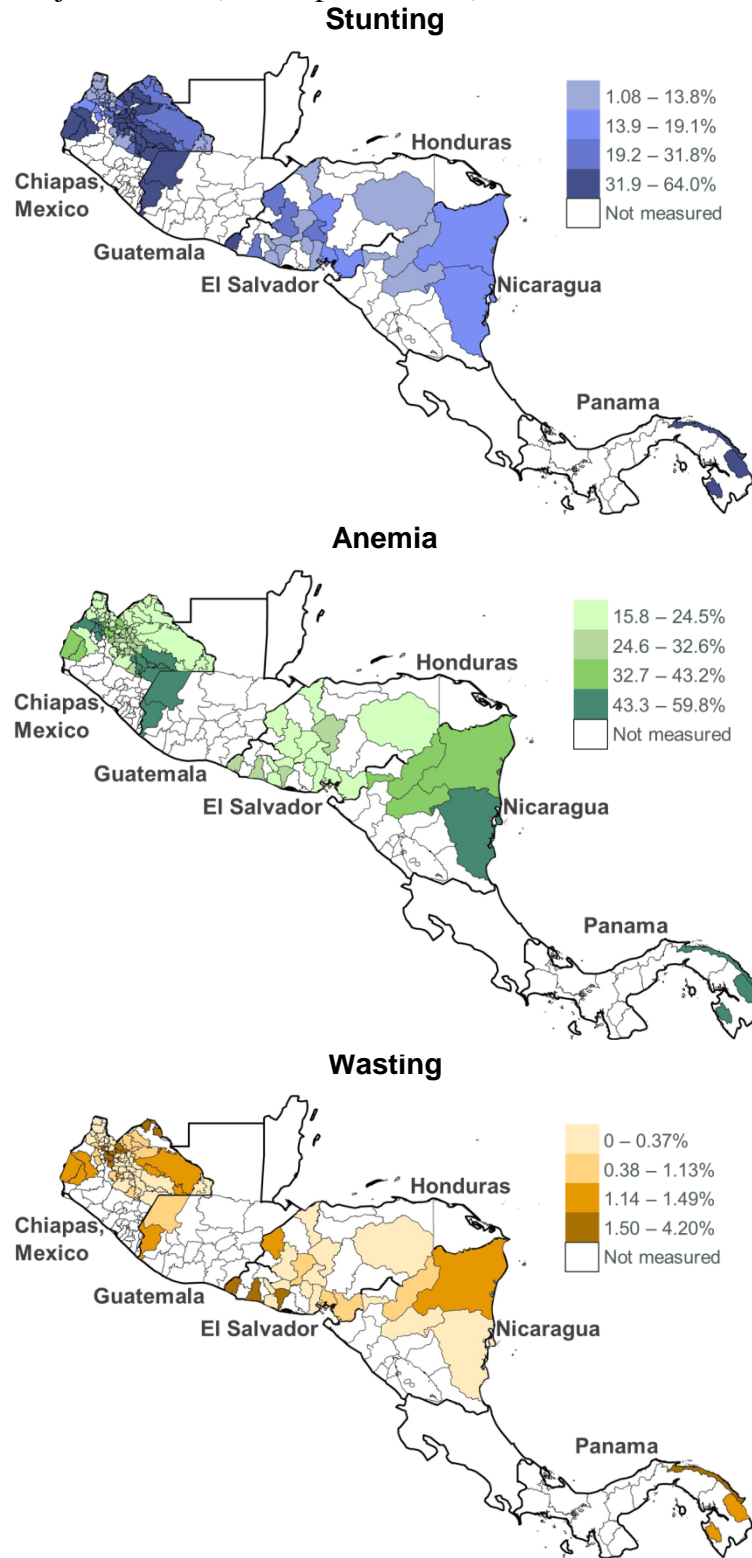
Figure 1. Comparison of the national and SM2015 prevalence of growth and anemia indicators by country, among children 0-59 months for growth and 6-59 months for anemia^a.



National estimates of growth problems are from WHO Global Database on Child Growth and Malnutrition⁷ with survey years: El Salvador 2008; Guatemala 2008-09; Honduras 2011-12; Chiapas, Mexico 2011-12; Nicaragua 2006-07; and Panama 2008. Anemia data is from Mujica-Coopman et al., 2015¹⁸ from survey years: El Salvador 2008; Guatemala 2009; Honduras 2005; Mexico 2006; Nicaragua 2003-05; and Panama 2000.
^aNational anemia estimate in Mexico is for children 12-23 months.

Maps of the department-level prevalence of stunting, wasting, and anemia are presented in Figure 2. The prevalence of stunting is as low as 1.1% and as high as 64.0% within a department, with the highest prevalence in Mexico, Guatemala, and Panama. There is less variation in the prevalence of anemia than stunting between departments, ranging from 15.8% to 59.8%. Guatemala, Panama, and the South Atlantic Autonomous Region of Nicaragua have particularly high prevalence of anemia. Wasting shows a different distribution pattern than stunting or anemia; while the prevalence of wasting is less than 5.0% in all departments, some departments in El Salvador experience four times higher prevalence than their neighbors.

Figure 2. Quartile of prevalence of stunting, anemia, and wasting at the level of the department or health jurisdiction (in Chiapas, Mexico).



Pooled analysis of the correlates of growth and anemia are presented in Tables 5-8; multivariable regressions stratified by country are available in Appendix Tables A7-A12.

Children in SM2015 areas are more likely to be stunted and severely stunted if they are female (odds ratio [OR]=0.857, 95% confidence interval [CI]: 0.766-0.958; and OR=0.833, 95% CI: 0.706-0.983, respectively) (Table 5). There is a strong association of stunting with age; likelihood is highest for the oldest children. Children who were born at low birth weight are more likely to be stunted (OR=1.622, 95% CI: 1.279-2.055) and severely stunted (OR=1.553, 95% CI: 1.100-2.191). Socio-economic factors including maternal education and household wealth (as measured through household expenditure and assets) are associated with lower odds of stunting. Indigenous status (OR=1.937, 95% CI: 1.520-2.468) and urbanicity (OR=0.696, 95% CI: 0.557-0.870) are also important correlates of stunting. Country stratified analyses show that maternal education is not associated with stunting or severe stunting in El Salvador, Nicaragua, or Panama (Appendix Table A7-A8). Low birth weight is not statistically associated with stunting in Panama. A mother being employed is associated with lower risk of stunting in Guatemala (OR=0.378, 95% CI: 0.245-0.582). Among children age 6-59 months, there is evidence that exclusive breastfeeding for the first six months of life is associated with increased odds of stunting (OR=1.144, 95% CI: 1.023,1.279) (Appendix Table A13) and not associated with underweight or anemia (data not shown).

Few individual, maternal, and household characteristics are associated with wasting in the bivariate or multivariable analysis (Table 6). The country in which the child lives is important; when controlling for other factors, children in Guatemala, Honduras, and Mexico are less likely to be wasted than children in El Salvador. Low birth weight has a strong association with wasting (OR=2.228, 95% CI: 1.242-3.995). Older children are less likely than younger

children to be wasted. In the stratified analysis for Honduras, children with recent illness are more likely to be wasted (OR= 3.427, 95% CI: 1.155-10.17) (Appendix Table S10).

Older children are also less likely to be overweight (Table 6). There is some weak evidence that additional household wealth is associated with a child being overweight. Children in households with a female head of household are less likely to be overweight (OR: 0.728, 95% CI: 0.558-0.951). Living in an indigenous area also makes a child also less likely to be overweight (OR=0.670, 95% CI: 0.518-0.867). In Nicaragua, children in urban areas are less likely to be overweight (OR= 0.447, 95% CI: 0.261-0.766) (Appendix Table A11). Children in Panama who were recently ill have increased odds of being overweight (OR= 2.153, 95% CI: 1.121-4.135).

Children who were born at low birth weight (OR=2.711, 95% CI: 1.936-3.795) or recently experienced illness (OR=1.360, 95% CI: 1.071-1.729) are more likely to be underweight (Table 7). Female children have lower odds of being underweight than male children (OR=0.583, 95% CI: 0.456-0.744). More maternal education is associated with lower likelihood of underweight. Children from indigenous households are more likely to be underweight (OR=2.157, 95% CI: 1.233-3.775). Stratified country analysis shows that being indigenous in Nicaragua is associated with much higher odds of being underweight (OR=7.632, 95% CI: 1.334,43.65) (Appendix Table A9). In Honduras, when adjusting for all other factors, maternal education is protective against underweight but maternal literacy is associated with higher odds of underweight (OR=2.006, 95% CI: 1.086-3.706).

Anemia prevalence is highest among the youngest children. Recent illness is associated with anemia (OR=1.157, 95% CI: 1.029-1.300) (Table 8). Children who were born at low birth weight are less likely to be anemic (OR=0.786, 95% CI: 0.632-0.977). Children from urban areas

are less likely to be anemic (OR=0.753, 95% CI: 0.605-0.937), as are those whose mothers have more education. In Honduras, having been born at low birth weight is associated with lower odds of anemia (OR=0.636, 95% CI: 0.406-0.998) (Appendix Table A12). Wealth as measured by household expenditure is protective against anemia in Panama, while wealth measured by assets is associated with lower likelihood of anemia in Guatemala.

Table 5. Correlates of stunting and severe stunting among the SM2015 population, ages 0-59 months^a.

		Stunting (N=17,950)				Severe stunting (N=17,950)				
		Bivariate		Multivariate		Bivariate		Multivariate		
		OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	
Country	El Salvador	1	(ref)	1	(ref)	1	(ref)	1	(ref)	
	Guatemala	6.914***	[5.474,8.732]	3.501***	[2.576,4.758]	8.913***	[6.257,12.70]	3.197***	[2.043,5.001]	
	Honduras	1.403*	[1.059,1.858]	1.021	[0.781,1.336]	1.468	[0.959,2.248]	1.01	[0.686,1.488]	
	Mexico	2.763***	[2.161,3.534]	1.311	[0.939,1.831]	3.287***	[2.269,4.762]	1.198	[0.757,1.897]	
	Nicaragua	0.769	[0.585,1.010]	0.555***	[0.421,0.734]	0.79	[0.486,1.283]	0.545**	[0.354,0.840]	
	Panama	6.446***	[4.713,8.817]	2.064***	[1.358,3.138]	6.479***	[4.332,9.691]	1.533	[0.872,2.695]	
Child characteristics	Female	0.915	[0.829,1.010]	0.857**	[0.766,0.958]	0.870	[0.745,1.016]	0.833*	[0.706,0.983]	
	Age	0-11 months	1	(ref)	1	(ref)	1	(ref)	1	(ref)
		12-23 months	3.070***	[2.542,3.707]	3.843***	[3.145,4.695]	3.010***	[2.051,4.418]	3.402***	[2.301,5.029]
		24-35 months	4.876***	[4.062,5.852]	6.235***	[5.070,7.668]	5.120***	[3.473,7.550]	5.695***	[3.751,8.645]
		36-47 months	5.195***	[4.287,6.294]	6.924***	[5.602,8.559]	5.124***	[3.522,7.455]	5.776***	[3.873,8.615]
		48-59 months	4.830***	[4.077,5.723]	6.651***	[5.457,8.107]	4.190***	[2.855,6.147]	4.828***	[3.194,7.299]
	Low birth weight	1.104	[0.885,1.377]	1.622***	[1.279,2.055]	1.083	[0.797,1.472]	1.553*	[1.100,2.191]	
Sick in past 2 weeks	0.817***	[0.735,0.908]	1.03	[0.921,1.151]	0.793**	[0.682,0.923]	1.002	[0.851,1.180]		
Maternal characteristics	Age	15-19 years	1	(ref)	1	(ref)	1	(ref)	1	(ref)
		20-34 years	1.299**	[1.072,1.575]	0.728**	[0.576,0.918]	1.272	[0.968,1.671]	0.697*	[0.517,0.941]
		35-49 years	1.533***	[1.230,1.911]	0.515***	[0.387,0.686]	1.618**	[1.198,2.185]	0.547**	[0.374,0.799]
	Parity	1 child	1	(ref)	1	(ref)	1	(ref)	1	(ref)
		2-3 children	1.628***	[1.411,1.878]	1.272**	[1.088,1.487]	1.790***	[1.425,2.247]	1.387**	[1.095,1.758]
		4-5 children	2.697***	[2.287,3.180]	1.675***	[1.381,2.033]	3.049***	[2.388,3.892]	1.812***	[1.410,2.330]
		6 or more children	3.665***	[3.071,4.375]	1.900***	[1.508,2.393]	4.154***	[3.242,5.324]	1.997***	[1.468,2.717]
	Marital status	Married or in union	1	(ref)	1	(ref)	1	(ref)	1	(ref)
		Single	0.539***	[0.430,0.674]	1.062	[0.836,1.348]	0.583**	[0.398,0.854]	1.22	[0.875,1.701]
		Divorced, separated, widowed, other	1.057	[0.827,1.350]	1.287	[0.969,1.711]	0.909	[0.662,1.247]	1.117	[0.729,1.714]
	Education	None	1	(ref)	1	(ref)	1	(ref)	1	(ref)
		Primary	0.552***	[0.476,0.639]	0.766**	[0.654,0.898]	0.492***	[0.413,0.585]	0.739**	[0.603,0.905]
		Secondary or more	0.266***	[0.217,0.325]	0.594***	[0.470,0.752]	0.195***	[0.150,0.252]	0.497***	[0.358,0.688]
Literate	0.429***	[0.377,0.487]	0.915	[0.790,1.059]	0.362***	[0.307,0.427]	0.855	[0.698,1.048]		
Occupational status	Homemaker	1	(ref)	1	(ref)	1	(ref)	1	(ref)	
	Employed	0.379***	[0.262,0.549]	0.710*	[0.507,0.992]	0.426**	[0.240,0.757]	0.961	[0.506,1.827]	
	Student, working without pay, other	0.982	[0.658,1.465]	1.449	[0.881,2.383]	0.766	[0.423,1.390]	1.076	[0.609,1.900]	

Household and community characteristics	1		1 (ref)		1 (ref)		1 (ref)		1 (ref)	
	Household expenditure quintile	2	0.830*	[0.718,0.960]	0.846*	[0.725,0.987]	0.738**	[0.596,0.915]	0.748*	[0.591,0.947]
	3	0.636***	[0.534,0.759]	0.711***	[0.589,0.858]	0.575***	[0.466,0.710]	0.663***	[0.531,0.827]	
	4	0.536***	[0.443,0.649]	0.651***	[0.539,0.786]	0.568***	[0.439,0.735]	0.736*	[0.562,0.964]	
	5	0.418***	[0.333,0.524]	0.559***	[0.434,0.721]	0.418***	[0.307,0.567]	0.604**	[0.429,0.849]	
Asset index		0.0891***	[0.0491,0.162]	0.231***	[0.122,0.438]	0.0554***	[0.0251,0.122]	0.156***	[0.0665,0.364]	
Household size		1.116***	[1.095,1.138]	1.071***	[1.045,1.098]	1.115***	[1.089,1.141]	1.053**	[1.018,1.089]	
Urban ^b		0.477***	[0.377,0.604]	0.696**	[0.557,0.870]	0.457***	[0.341,0.611]	0.726*	[0.545,0.969]	
Female head of household		0.738**	[0.612,0.890]	1.149	[0.920,1.435]	0.745*	[0.564,0.983]	1.14	[0.816,1.591]	
Indigenous household ^c		3.446***	[2.877,4.128]	1.937***	[1.520,2.468]	4.236***	[3.362,5.337]	2.320***	[1.663,3.236]	

*p-value<0.05 **p-value <0.01 ***p-value <0.001

^aMultivariable analysis is adjusted for all variables in column.

^bAll households in Panama were in rural areas.

^cAll households in El Salvador were non-indigenous, and all households in Panama were indigenous.

Table 6. Correlates of wasting and overweight among the SM2015 population, ages 0-59 months^a.

		Wasting (N=17,919)				Overweight (N=17,919)				
		Univariate		Multivariate		Bivariate		Multivariate		
		OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	
Country	El Salvador	1	(ref)	1	(ref)	1	(ref)	1	(ref)	
	Guatemala	0.350***	[0.222,0.552]	0.445*	[0.215,0.919]	0.888	[0.676,1.167]	1.279	[0.884,1.851]	
	Honduras	0.299***	[0.155,0.579]	0.343**	[0.159,0.741]	0.973	[0.722,1.311]	1.157	[0.816,1.640]	
	Mexico	0.312***	[0.188,0.518]	0.439*	[0.206,0.934]	1.226	[0.968,1.553]	1.830***	[1.296,2.585]	
	Nicaragua	0.394**	[0.222,0.700]	0.483	[0.225,1.034]	1.493*	[1.029,2.167]	1.883**	[1.227,2.888]	
	Panama	0.62	[0.359,1.069]	0.974	[0.339,2.798]	0.535***	[0.369,0.774]	0.97	[0.571,1.648]	
Child characteristics	Female	0.620	[0.366,1.050]	0.613	[0.364,1.033]	0.782*	[0.645,0.948]	0.783*	[0.645,0.951]	
	Age	0-11 months	1	(ref)	1	(ref)	1	(ref)	1	(ref)
		12-23 months	0.941	[0.535,1.657]	0.947	[0.536,1.672]	0.499***	[0.368,0.675]	0.498***	[0.365,0.679]
		24-35 months	0.411*	[0.204,0.826]	0.389**	[0.195,0.778]	0.423***	[0.315,0.570]	0.427***	[0.316,0.577]
		36-47 months	0.311**	[0.152,0.635]	0.315**	[0.153,0.649]	0.489***	[0.382,0.627]	0.478***	[0.368,0.622]
		48-59 months	0.389*	[0.155,0.976]	0.384*	[0.159,0.926]	0.477***	[0.342,0.665]	0.455***	[0.322,0.645]
	Low birth weight	2.367**	[1.277,4.384]	2.228**	[1.242,3.995]	0.857	[0.558,1.317]	0.869	[0.577,1.307]	
Sick in past 2 weeks	1.720*	[1.122,2.638]	1.508	[0.981,2.317]	0.884	[0.737,1.062]	0.829	[0.682,1.007]		
Maternal characteristics	Age	15-19 years	1	(ref)	1	(ref)	1	(ref)	1	(ref)
		20-34 years	0.737	[0.317,1.709]	1.061	[0.479,2.350]	0.835	[0.625,1.115]	1.036	[0.756,1.419]
		35-49 years	0.8	[0.334,1.915]	1.376	[0.513,3.694]	0.925	[0.643,1.331]	1.157	[0.731,1.830]
	Parity	1 child	1	(ref)	1	(ref)	1	(ref)	1	(ref)
		2-3 children	0.838	[0.445,1.576]	0.969	[0.532,1.765]	0.815	[0.640,1.038]	0.903	[0.694,1.174]
		4-5 children	0.767	[0.411,1.430]	0.83	[0.449,1.535]	0.663*	[0.478,0.918]	0.8	[0.550,1.164]
		6 or more children	0.665	[0.340,1.300]	0.595	[0.232,1.525]	0.906	[0.665,1.236]	1.123	[0.724,1.743]
	Marital status	Married or in union	1	(ref)	1	(ref)	1	(ref)	1	(ref)
		Single Divorced, separated, widowed, other	1.107	[0.397,3.086]	0.999	[0.346,2.883]	0.826	[0.578,1.180]	0.877	[0.611,1.260]
	Education	None	1	(ref)	1	(ref)	1	(ref)	1	(ref)
		Primary	0.773	[0.449,1.331]	0.707	[0.351,1.422]	0.961	[0.711,1.298]	0.986	[0.734,1.325]
		Secondary or more	0.624	[0.309,1.257]	0.505	[0.205,1.245]	1.312	[0.968,1.780]	1.328	[0.934,1.887]
	Literate	0.887	[0.586,1.343]	0.92	[0.557,1.520]	1.081	[0.895,1.307]	0.835	[0.666,1.047]	
Occupational status	Homemaker	1	(ref)	1	(ref)	1	(ref)	1	(ref)	
	Employed	0.977	[0.339,2.819]	1.084	[0.429,2.741]	0.975	[0.650,1.461]	0.883	[0.558,1.398]	
	Student, working without pay, other	2.147	[0.365,12.62]	2.405	[0.494,11.70]	0.917	[0.502,1.676]	0.861	[0.446,1.662]	

Household and community characteristics	1	1	(ref)	1	(ref)	1	(ref)	1	(ref)
	Household expenditure quintile	2	1.752	[0.845,3.631]	1.713	[0.834,3.517]	1.043	[0.745,1.460]	1.029
	3	0.923	[0.401,2.127]	0.915	[0.377,2.222]	1.420*	[1.035,1.948]	1.392*	[1.015,1.909]
	4	0.873	[0.411,1.855]	0.788	[0.339,1.832]	1.167	[0.874,1.557]	1.113	[0.811,1.526]
	5	0.89	[0.418,1.895]	0.827	[0.303,2.257]	1.486*	[1.079,2.047]	1.478*	[1.079,2.023]
Asset index		2.311	[0.331,16.11]	2.343	[0.273,20.11]	2.805*	[1.126,6.988]	2.113	[0.789,5.658]
Household size		0.978	[0.904,1.060]	1.004	[0.924,1.091]	0.987	[0.951,1.025]	0.97	[0.927,1.014]
Urban ^b		0.885	[0.509,1.541]	1.013	[0.562,1.826]	0.966	[0.764,1.222]	0.809	[0.623,1.053]
Female head of household		1,188	[0.574,2.457]	0.899	[0.452,1.786]	0.832	[0.646,1.071]	0.728*	[0.558,0.951]
Indigenous household ^c		0.766	[0.490,1.196]	0.858	[0.431,1.706]	0.709**	[0.557,0.904]	0.670**	[0.518,0.867]

*p-value<0.05 **p-value <0.01 ***p-value <0.001

^aMultivariable analysis is adjusted for all variables in column.

^bAll households in Panama were in rural areas.

^cAll households in El Salvador were non-indigenous, and all households in Panama were indigenous.

Table 7. Correlates of underweight among the SM2015 population, ages 0-59 months^a.

		Underweight (N=17,969)				
		Bivariate		Multivariate		
		OR	95% CI	OR	95% CI	
Country	El Salvador	1	(ref)	1	(ref)	
	Guatemala	1.814***	[1.335,2.467]	0.694	[0.369,1.304]	
	Honduras	0.613*	[0.408,0.920]	0.498**	[0.321,0.772]	
	Mexico	0.595**	[0.420,0.843]	0.245***	[0.129,0.463]	
	Nicaragua	0.363**	[0.198,0.665]	0.287***	[0.163,0.506]	
	Panama	1.837**	[1.252,2.696]	0.592	[0.270,1.298]	
Child characteristics	Female	0.606***	[0.472,0.778]	0.583***	[0.456,0.744]	
	Age	0-11 months	1	(ref)	1	(ref)
		12-23 months	1.568*	[1.112,2.211]	1.671**	[1.187,2.352]
		24-35 months	2.180***	[1.518,3.130]	2.251***	[1.546,3.278]
		36-47 months	1.694**	[1.193,2.405]	1.865***	[1.308,2.660]
		48-59 months	1.25	[0.820,1.905]	1.405	[0.918,2.151]
	Low birth weight	2.384***	[1.657,3.428]	2.711***	[1.936,3.795]	
Sick in past 2 weeks	1.232	[0.977,1.554]	1.360*	[1.071,1.729]		
Maternal characteristics	Age	15-19 years	1	(ref)	1	(ref)
		20-34 years	0.839	[0.519,1.356]	0.628	[0.383,1.031]
		35-49 years	1.042	[0.646,1.679]	0.523*	[0.307,0.891]
	Parity	1 child	1	(ref)	1	(ref)
		2-3 children	1.174	[0.825,1.671]	1.234	[0.904,1.684]
		4-5 children	1.579*	[1.040,2.398]	1.452	[0.958,2.200]
		6 or more children	2.250***	[1.532,3.303]	1.698*	[1.084,2.660]
	Marital status	Married or in union	1	(ref)	1	(ref)
		Single	0.735	[0.411,1.315]	1.029	[0.625,1.694]
		Divorced, separated, widowed, other	1.173	[0.723,1.905]	1.56	[0.959,2.539]
	Education	None	1	(ref)	1	(ref)
		Primary	0.491***	[0.374,0.645]	0.694*	[0.518,0.930]
		Secondary or more	0.296***	[0.202,0.433]	0.634*	[0.410,0.982]
Literate	0.456***	[0.360,0.579]	0.797	[0.579,1.099]		
Occupational status	Homemaker	1	(ref)	1	(ref)	
	Employed	0.323**	[0.139,0.751]	0.474	[0.213,1.052]	
	Student, working without pay, other	1.066	[0.376,3.025]	1.205	[0.444,3.271]	
Household and community characteristics	Household expenditure quintile	1	1	(ref)	1	(ref)
		2	0.894	[0.642,1.246]	0.912	[0.650,1.279]
		3	0.447***	[0.314,0.638]	0.491***	[0.338,0.714]
		4	0.505***	[0.348,0.733]	0.563**	[0.386,0.820]
		5	0.615*	[0.408,0.928]	0.755	[0.475,1.200]
	Asset index	0.174***	[0.0673,0.448]	0.451	[0.175,1.167]	
	Household size	1.085***	[1.047,1.124]	1.052*	[1.000,1.106]	
	Urban ^b	0.624*	[0.414,0.941]	1.019	[0.714,1.454]	
	Female head of household	0.796	[0.507,1.250]	0.812	[0.530,1.242]	
Indigenous household ^c	2.188***	[1.664,2.878]	2.157**	[1.233,3.775]		

*p-value<0.05 **p-value <0.01 ***p-value <0.001

^aMultivariable analysis is adjusted for all variables in column.

^bAll households in Panama were in rural areas.

^cAll households in El Salvador were non-indigenous, and all households in Panama were indigenous.

Table 8. Correlates of anemia among the SM2015 population, ages 0-59 months.

		Anemia (N=15,042)				
		Bivariate		Multivariate		
		OR	95% CI	OR	95% CI	
Country	El Salvador	1	(ref)	1	(ref)	
	Guatemala	2.737***	[2.207,3.395]	2.744***	[1.992,3.780]	
	Honduras	0.827	[0.675,1.013]	0.693**	[0.542,0.888]	
	Mexico	0.942	[0.792,1.121]	0.958	[0.736,1.247]	
	Nicaragua	1.650***	[1.359,2.003]	1.606***	[1.271,2.028]	
	Panama	2.971***	[2.352,3.753]	2.834***	[1.893,4.243]	
Child characteristics	Female	0.920	[0.833,1.017]	0.903	[0.813,1.003]	
	Age	0-11 months	1	(ref)	1	(ref)
		12-23 months	0.461***	[0.391,0.544]	0.451***	[0.380,0.534]
		24-35 months	0.300***	[0.251,0.357]	0.291***	[0.242,0.350]
		36-47 months	0.233***	[0.194,0.280]	0.231***	[0.191,0.281]
		48-59 months	0.195***	[0.161,0.235]	0.190***	[0.155,0.231]
	Low birth weight	0.828	[0.665,1.031]	0.786*	[0.632,0.977]	
Sick in past 2 weeks	1.260***	[1.128,1.407]	1.157*	[1.029,1.300]		
Maternal characteristics	Age	15-19 years	1	(ref)	1	(ref)
		20-34 years	0.720***	[0.600,0.864]	0.949	[0.786,1.147]
		35-49 years	0.579***	[0.469,0.716]	0.796	[0.617,1.028]
	Parity	1 child	1	(ref)	1	(ref)
		2-3 children	0.824**	[0.717,0.947]	1.023	[0.878,1.193]
		4-5 children	0.906	[0.770,1.067]	1.227*	[1.020,1.476]
		6 or more children	0.727**	[0.597,0.884]	0.965	[0.721,1.292]
	Marital status	Married or in union	1	(ref)	1	(ref)
		Single	1.274*	[1.021,1.589]	1.13	[0.876,1.459]
		Divorced, separated, widowed, other	1.118	[0.882,1.416]	1.135	[0.862,1.494]
	Education	None	1	(ref)	1	(ref)
		Primary	0.909	[0.797,1.038]	0.847*	[0.719,0.996]
		Secondary or more	0.843	[0.709,1.002]	0.747*	[0.584,0.954]
Literate	1.049	[0.928,1.184]	1.148	[0.977,1.350]		
Occupational status	Homemaker	1	(ref)	1	(ref)	
	Employed	0.753*	[0.605,0.937]	0.827	[0.658,1.040]	
	Student, working without pay, other	0.819	[0.515,1.301]	0.77	[0.467,1.271]	
Household and community characteristics	Household expenditure quintile	1	1	(ref)	1	(ref)
		2	1.01	[0.856,1.191]	0.993	[0.832,1.185]
		3	1.049	[0.876,1.255]	1.062	[0.887,1.270]
		4	0.882	[0.747,1.042]	0.921	[0.783,1.084]
		5	0.919	[0.766,1.104]	1.012	[0.833,1.228]
	Asset index	0.535*	[0.331,0.864]	0.644	[0.365,1.138]	
	Household size	1.028*	[1.002,1.054]	1.021	[0.988,1.055]	
	Urban ^b	0.721***	[0.596,0.874]	0.753*	[0.605,0.937]	
	Female head of household	1.114	[0.937,1.325]	0.992	[0.814,1.209]	
Indigenous household ^c	0.881	[0.741,1.047]	0.882	[0.700,1.111]		

*p-value<0.05 **p-value <0.01 ***p-value <0.001

^aMultivariable analysis is adjusted for all variables in column.

^bAll households in Panama were in rural areas.

^cAll households in El Salvador were non-indigenous, and all households in Panama were indigenous.

DISCUSSION

In Mesoamerica, there is a rapid transition toward childhood problems faced in high income countries, as the prevalence of stunting and wasting drop and rates of childhood overweight rise. However, our study revealed that there remain very high rates of stunting and anemia in the poorest areas of the region, with wide variation in the prevalence of anemia and growth outcomes within and between countries. Furthermore, this study showed the association of socioeconomic characteristics with both growth attainment and anemia. These results should be used to tailor intervention programs in affected areas, and should be used as a baseline to monitor progress toward nation and international goals.

This analysis provides insight into the nutritional outcomes among populations in the poorest quintile of six Mesoamerican countries. In all countries, there are food supplementation and fortified food programs¹⁸, however our results demonstrate that low-resource, high-risk populations are not benefitting from those programs. In addition, findings suggest that the context of the country and community are critical in identifying those children. The poor in Mesoamerica is not a homogenous group. The diverse population of this region can make tailoring interventions to these communities difficult²³. Previous studies have demonstrated that indigenous populations are at higher risk for poor growth attainment²⁴. In Chiapas, Mexico, where there has been social and political conflict between the government and social groups in the past decade, intracommunity conflict was found to be associated with stunting prevalence²⁵. During conflict, certain social services and access to care may be restricted, leaving children in these communities particularly vulnerable.

As these countries continue the epidemiologic transition, program changes are necessary. In Mexico, public health policy has been successful in decreasing rates of sugar sweetened

beverage consumption²⁶. However, these taxes are more burdensome on the poor. Healthy food can be expensive, so ensuring access to cheap and nutritious food for both children and their families is critical, especially in an age with growing access to processed, high-sugar, and high-calorie “junk food”. Programs to educate parents and communities about healthy eating behaviors for their children are also needed. Nutrition in early life can greatly impact later health and economic success¹⁴. A program to educate parents should focus on types and quantities of foods that are needed for a healthy weight and development. Involvement of fathers in education about child diet practices has been shown to be effective in changing practices in Guatemala²³.

This study has some limitations. First, this data is cross-sectional and thus I am not able to determine whether there is a causal relationship between study variables and outcomes. Second, not all children have consent and valid measurements for body size or hemoglobin concentration. Third, some of our variables are self-reported and could be subject to recall and desirability biases. Fourth, while we can measure the prevalence of anemia, we cannot ascertain the cause of anemia at the individual or population level, thus limiting the utility of results for intervention targeting. Finally, while this study will help to close the gap in knowledge about and predictors of growth and anemia in Mesoamerica, results are not generalizable to other populations or health systems. However, this is the largest study conducted in the poorest areas of Mesoamerica. Standard methodology for data collection and standardized physical measures allows for analysis between and within countries.

This study demonstrates a high burden of chronic undernutrition in the poorest quintile of Mesoamerica, with persistent low prevalence of wasting and a higher prevalence of overweight than underweight. Interventions to eliminate undernutrition in the region should target at-risk children in these communities and ensure that dietary changes are sustainable and do not lead to

rising rates of overweight that are seen in the general population. This could have a substantial improvement on the health and well-being of children, families, and communities, and propel economic development in the region.

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APPENDIX

Figure A1. Conceptual framework for the causes of undernutrition.

Source: Black et al., 2008¹³.

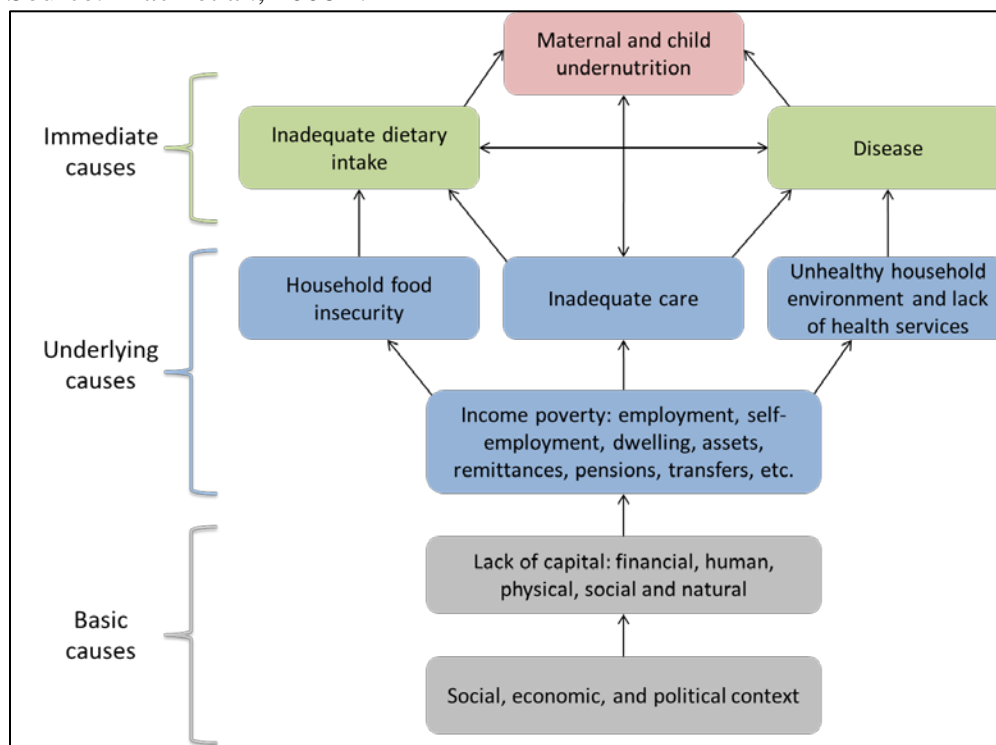


Table A1. The frequency of implausible standardized growth values and resulting number of children excluded from analysis.

Growth metric	Plausibility range	Children excluded, N (%)
Weight for height	Lower: -5	6 (0.03%)
	Upper: 5	82 (0.4%)
Height for age	Lower: -6	145 (0.7%)
	Upper: 6	58 (0.3%)
Weight for age	Lower: -6	0 (0%)
	Upper: 5	80 (0.4%)
Total		298 (1.4%)

Table A2. Response rates for the SM2015 baseline evaluation household survey.

Country	Census Survey				Household Survey			
	Households		Households		Women		Children	
	N	Resp. rate	N	Resp. rate	N	Resp. rate	N	Resp. rate
El Salvador	16,178	88%	3,625	92%	4,730	91%	3,328	87%
Guatemala	20,451	100%	4,420	93%	5,899	90%	5,282	93%
Honduras	15,741	99.9%	2,971	99%	3,342	86%	3,144	97%
Mexico	24,349	99%	6,988	97%	5,016	95%	6,462	99%
Nicaragua	8,867	100%	2,071	94%	2,823	92%	2,225	99%
Panama	4,947	100%	1,710	95%	2,453	82%	2,253	93%
Total	90,533		20,225		24,614		23,005	

Table A3. Reasons for non-consent for child measurement of height and weight, by country, among children 0-59 months.

	El Salvador	Guatemala	Honduras	Mexico	Nicaragua	Panama	Total
Refused	21.7%	40.7%	61.9%	74.3%	58.3%	50.1%	55.0%
Absent	37.0%	40.1%	28.8%	16.6%	30.0%	33.0%	29.9%
Sick	2.2%	4.9%	0.0%	6.1%	3.3%	2.0%	4.2%
Other	39.1%	14.3%	9.3%	3.0%	8.3%	14.9%	11.0%

Table A4. Characteristics of children who did and did not receive consent for body measurements.

		Without consent N=2,275	With consent N=20,730	P-value		
Country	El Salvador	0.98%	3.93%	<0.001		
	Guatemala	7.87%	6.83%			
	Honduras	6.96%	8.05%			
	Mexico	69.18%	50.57%			
	Nicaragua	10.92%	28.91%			
	Panama	4.09%	1.71%			
Child characteristics	Female	48.45%	49.84%	0.494		
	Age	0-11 months	20.14%	20.56%	0.898	
		12-23 months	21.92%	21.44%		
		24-35 months	19.46%	20.09%		
		36-47 months	19.86%	20.55%		
		48-59 months	18.62%	17.36%		
	Low birth weight	4.52%	6.63%	0.061		
Exclusive breastfeeding for 6 months ^a	46.18%	45.11%	0.736			
Sick in past 2 weeks	19.22%	31.28%	<0.001			
Maternal characteristics	Age	15-19 years	7.63%	9.90%	0.213	
		20-34 years	73.92%	70.98%		
		35-49 years	18.45%	19.12%		
	Parity	1 child	20.85%	22.29%	0.663	
		2-3 children	44.12%	42.42%		
		4-5 children	18.19%	19.82%		
		6 or more children	16.84%	15.46%		
	Marital status	Married or in union	89.95%	87.21%	0.106	
		Single	4.85%	7.45%		
	Education	Divorced, separated, widowed, other	5.20%	5.35%	<0.0001	
None		24.33%	15.54%			
Primary		46.73%	55.37%			
Literate	Secondary or more	28.94%	29.08%	0.028		
	Occupational status	Homemaker	87.92%		90.06%	
Household and community characteristics	Household expenditure quintile	Employed	9.93%	8.05%	0.409	
		Student, working without pay, other	2.15%	1.89%		
		1	21.56%	21.76%		
		2	19.38%	21.37%		
		3	21.27%	20.33%		
Household and community characteristics	Household expenditure quintile	4	18.24%	18.96%	0.766	
		5	19.55%	17.59%		
		Asset index	0.221	0.237		<0.001
		Household size	5.869	5.941		0.438
		Urban ^b	32.61%	29.40%		0.482
	Female head of household	11.52%	14.00%	0.231		
	Indigenous household ^c	64.32%	47.60%	0.001		

^aAmong children 6-59 months old. Sample size for children without consent is 2,060 and for children with consent is 18,878.

^bAll households in Panama were in rural areas.

^cAll households in El Salvador were non-indigenous, and all households in Panama were indigenous.

Table A5. Reasons for non-consent for child finger prick for hemoglobin, by country, among children 6-59 months.

	El Salvador	Guatemala	Honduras	Mexico	Nicaragua	Panama	Total
Refused	79.9%	28.5%	91.9%	78.6%	95.4%	71.4%	80.9%
Insufficient blood	0.9%	0.0%	5.7%	2.4%	0.4%	3.6%	1.5%
Could not puncture	0.5%	0.6%	0.8%	0.0%	0.2%	0.0%	0.5%
Other	18.7%	70.9%	1.6%	19.1%	4.0%	25.0%	17.1%

Table A6. Characteristics of children who did and did not receive consent for finger prick test for hemoglobin, among those age 6-59 months.

		Without consent	With consent		
		N=3,912	N=16,964	P-value	
Country	El Salvador	12.45%	16.43%	<0.001	
	Guatemala	29.35%	21.48%		
	Honduras	11.30%	14.15%		
	Mexico	22.55%	20.05%		
	Nicaragua	2.94%	11.00%		
	Panama	21.42%	6.89%		
Child characteristics	Female	48.87%	49.76%	0.525	
	Age	6-11 months	12.50%	11.24%	0.59
		12-23 months	23.80%	23.14%	
		24-35 months	21.50%	21.88%	
		36-47 months	21.55%	22.78%	
		48-59 months	20.65%	20.96%	
	Low birth weight	4.01%	6.14%	0.036	
Exclusive breastfeeding for 6 months	50.23%	46.02%	0.036		
Sick in past 2 weeks	21.74%	31.40%	<0.001		
Maternal characteristics	Age	15-19 years	6.75%	8.91%	0.05
		20-34 years	71.40%	71.02%	
		35-49 years	21.85%	20.06%	
	Parity	1 child	19.16%	21.67%	0.25
		2-3 children	43.12%	42.36%	
		4-5 children	19.09%	19.91%	
		6 or more children	18.63%	16.01%	
	Marital status	Married or in union	88.59%	86.87%	0.342
		Single	6.10%	7.47%	
		Divorced, separated, widowed, other	5.30%	5.67%	
	Education	None	23.91%	15.77%	<0.001
Primary		49.44%	55.27%		
Secondary or more		26.65%	28.97%		
Literate		50.78%	60.36%	0.002	
Occupational status	Homemaker	88.57%	90.04%	0.498	
	Employed	9.10%	8.11%		
	Student, working without pay, other	2.33%	1.85%		
Household and community characteristics	Household expenditure quintile	1	21.98%	20.95%	0.27
		2	21.19%	21.11%	
		3	17.81%	20.31%	
		4	18.46%	19.53%	
		5	20.56%	18.10%	
	Asset index		0.226	0.239	<0.001
	Household size		6.365	5.939	<0.001
	Urban ^a		30.46%	29.96%	0.883
Female head of household		14.70%	15.14%	0.788	
Indigenous household ^b		63.17%	46.73%	<0.001	

^aAll households in Panama were in rural areas.

^bAll households in El Salvador were non-indigenous, and all households in Panama were indigenous.

Table A7. Country-stratified analysis of individual, maternal, and household correlates of stunting, among children 0-59 months^a.

		El Salvador (N=2,892)		Guatemala (N=4,142)		Honduras (N=2,381)		
		OR	95% CI	OR	95% CI	OR	95% CI	
Child characteristics	Female	0.712**	[0.563,0.900]	0.784**	[0.671,0.916]	0.834	[0.659,1.055]	
	Age	0-11 months	1	(ref)	1	(ref)	1	(ref)
		12-23 months	3.592***	[2.156,5.985]	4.877***	[3.899,6.100]	8.182***	[4.440,15.08]
		24-35 months	2.356***	[1.440,3.854]	6.342***	[5.071,7.932]	10.74***	[5.995,19.24]
		36-47 months	3.222***	[1.979,5.245]	8.889***	[6.788,11.64]	14.21***	[7.897,25.55]
		48-59 months	3.519***	[2.090,5.925]	6.957***	[5.272,9.182]	17.50***	[9.754,31.38]
	Low birth weight	1.973***	[1.413,2.754]	1.818***	[1.322,2.501]	1.690**	[1.174,2.433]	
Sick in past 2 weeks	1.116	[0.886,1.405]	0.87	[0.725,1.044]	1.06	[0.832,1.351]		
Maternal characteristics	Age	15-19 years	1	(ref)	1	(ref)	1	(ref)
		20-34 years	0.593*	[0.398,0.884]	0.621***	[0.472,0.817]	0.437***	[0.272,0.702]
		35-49 years	0.518**	[0.315,0.851]	0.566**	[0.401,0.799]	0.275***	[0.154,0.490]
	Parity	1 child	1	(ref)	1	(ref)	1	(ref)
		2-3 children	1.332	[0.987,1.798]	1.296*	[1.037,1.619]	1.11	[0.803,1.534]
		4-5 children	1.962**	[1.316,2.925]	1.423**	[1.115,1.817]	1.711**	[1.181,2.479]
		6 or more children	3.610***	[2.310,5.639]	1.193	[0.893,1.592]	2.385***	[1.522,3.738]
	Marital status	Married or in union	1	(ref)	1	(ref)	1	(ref)
		Single	0.735	[0.472,1.144]	0.939	[0.717,1.228]	0.86	[0.581,1.275]
		Divorced, separated, widowed, other	1.297	[0.861,1.953]	1.314	[0.852,2.026]	1.525	[0.824,2.824]
	Education	None	1	(ref)	1	(ref)	1	(ref)
		Primary	1.121	[0.814,1.543]	0.721***	[0.603,0.862]	0.72	[0.424,1.224]
	Literate	Secondary or more	0.904	[0.620,1.320]	0.532***	[0.380,0.744]	0.387**	[0.199,0.752]
Literate		0.797	[0.569,1.115]	0.926	[0.748,1.147]	1.031	[0.804,1.324]	
Occupational status	Homemaker	1	(ref)	1	(ref)	1	(ref)	
	Employed	0.852	[0.527,1.378]	0.378***	[0.245,0.582]	1.198	[0.785,1.829]	
	Student, working without pay, other	1.784	[0.853,3.730]	0.616*	[0.394,0.963]	0.325	[0.102,1.030]	
Household and community characteristics	Household expenditure quintile	1	1	(ref)	1	(ref)	1	(ref)
		2	0.872	[0.640,1.186]	1.19	[0.909,1.557]	0.654**	[0.492,0.868]
		3	0.576**	[0.409,0.811]	1.317*	[1.004,1.728]	0.511***	[0.363,0.720]
		4	0.526**	[0.348,0.794]	0.975	[0.750,1.266]	0.570**	[0.380,0.856]
		5	0.400***	[0.258,0.621]	0.91	[0.715,1.158]	0.409***	[0.273,0.611]
	Asset index	0.170***	[0.0768,0.377]	0.838	[0.382,1.839]	0.0669***	[0.0191,0.235]	
	Household size	1.120*	[1.022,1.227]	1.064***	[1.034,1.095]	1.072	[0.999,1.150]	
	Urban ^b	0.757	[0.480,1.196]	0.818	[0.581,1.152]	0.789	[0.500,1.244]	
	Female head of household	0.945	[0.711,1.255]	1.019	[0.799,1.299]	1.022	[0.709,1.472]	
	Indigenous household ^c			1.251	[0.994,1.574]			

		Mexico (N=5,159)		Nicaragua (N=1,916)		Panama (N=1,450)		
		OR	95% CI	OR	95% CI	OR	95% CI	
Child characteristics	Female	0.908	[0.791,1.042]	0.742	[0.512,1.074]	0.843	[0.650,1.094]	
	Age	0-11 months	1	(ref)	1	(ref)	1	(ref)
		12-23 months	3.147***	[2.438,4.062]	7.504***	[2.689,20.94]	2.693***	[1.884,3.849]
		24-35 months	5.653***	[4.371,7.312]	12.66***	[4.382,36.56]	3.653***	[2.263,5.898]
		36-47 months	6.299***	[4.791,8.281]	12.34***	[4.423,34.43]	2.844***	[1.828,4.425]
		48-59 months	5.828***	[4.464,7.610]	12.74***	[5.095,31.88]	2.083***	[1.408,3.080]
	Low birth weight	1.568*	[1.040,2.364]	1.662*	[1.041,2.653]	0.839	[0.470,1.496]	
Sick in past 2 weeks	0.994	[0.861,1.148]	1.25	[0.891,1.752]	0.991	[0.765,1.285]		
Maternal characteristics	Age	15-19 years	1	(ref)	1	(ref)	1	(ref)
		20-34 years	0.744	[0.521,1.062]	0.73	[0.450,1.185]	1.426	[0.926,2.197]
		35-49 years	0.495***	[0.329,0.745]	0.549	[0.246,1.223]	1.591	[0.966,2.618]
	Parity	1 child	1	(ref)	1	(ref)	1	(ref)
		2-3 children	1.308*	[1.035,1.653]	1.348	[0.918,1.980]	0.939	[0.628,1.403]
		4-5 children	1.875***	[1.402,2.508]	1.169	[0.638,2.141]	1.101	[0.691,1.756]
		6 or more children	1.873***	[1.330,2.638]	2.287*	[1.138,4.596]	1.163	[0.665,2.034]
	Marital status	Married or in union	1	(ref)	1	(ref)	1	(ref)
		Single	0.772	[0.420,1.419]	1.337	[0.837,2.136]	1.193	[0.808,1.762]
		Divorced, separated, widowed, other	1.427	[0.892,2.283]	1.206	[0.633,2.298]	0.857	[0.502,1.462]
	Education	None	1	(ref)	1	(ref)	1	(ref)
		Primary	0.744**	[0.596,0.928]	0.891	[0.577,1.376]	0.745	[0.442,1.256]
		Secondary or more	0.568***	[0.409,0.788]	0.835	[0.430,1.622]	0.776	[0.424,1.418]
Literate	0.948	[0.779,1.153]	0.714	[0.451,1.130]	1.057	[0.741,1.507]		
Occupational status	Homemaker	1	(ref)	1	(ref)	1	(ref)	
	Employed	0.771	[0.436,1.364]	0.557	[0.309,1.006]	0.825	[0.476,1.429]	
	Student, working without pay, other	1.611	[0.724,3.589]	2.33	[0.797,6.810]	0.474	[0.198,1.133]	
Household and community characteristics	Household expenditure quintile	1	1	(ref)	1	(ref)	1	(ref)
		2	0.907	[0.738,1.114]	0.74	[0.478,1.147]	0.738	[0.472,1.155]
		3	0.723*	[0.552,0.948]	0.651	[0.399,1.063]	0.574*	[0.358,0.919]
		4	0.689**	[0.527,0.901]	0.544*	[0.317,0.932]	0.518**	[0.340,0.790]
		5	0.557**	[0.388,0.800]	0.619	[0.305,1.255]	0.371***	[0.239,0.577]
	Asset index	0.555	[0.196,1.566]	0.0277***	[0.00612,0.126]	0.0619***	[0.0151,0.254]	
	Household size	1.068**	[1.024,1.114]	1.080*	[1.017,1.147]	1.112***	[1.063,1.163]	
	Urban ^b	0.682*	[0.486,0.958]	0.609	[0.363,1.020]			
Female head of household	1.042	[0.652,1.667]	1.31	[0.864,1.988]	1.263	[0.933,1.709]		
Indigenous household ^c	2.037***	[1.425,2.912]	2.333**	[1.309,4.158]				

*p-value<0.05 **p-value <0.01 ***p-value <0.001

^aMultivariable analysis is adjusted for all variables in column.

^bAll households in Panama were in rural areas, so this variable was not included in the stratified regression for this country.

^cAll households in El Salvador were non-indigenous, and all households in Panama were indigenous, so this variable was not included in the stratified regression for these countries. Very few households in Honduras were indigenous, so this variable was not included in the stratified regression for this country.

Table A8. Country-stratified analysis of individual, maternal, and household correlates of severe stunting, among children 0-59 months^a.

		El Salvador (N=2,892)		Guatemala (N=4,142)		Honduras (N=2,381)		
		OR	95% CI	OR	95% CI	OR	95% CI	
Child characteristics	Female	0.677	[0.400,1.146]	0.744***	[0.630,0.879]	0.782	[0.524,1.169]	
	Age	0-11 months	1	(ref)	1	(ref)	1	(ref)
		12-23 months	2.431	[0.815,7.255]	4.469***	[3.366,5.934]	6.734***	[2.218,20.45]
		24-35 months	1.251	[0.446,3.506]	5.288***	[3.949,7.081]	12.91***	[3.824,43.56]
		36-47 months	1.848	[0.920,3.713]	6.639***	[4.823,9.139]	12.11***	[4.223,34.75]
		48-59 months	1.958	[0.817,4.695]	5.114***	[3.715,7.041]	13.19***	[4.116,42.29]
	Low birth weight	1.935*	[1.157,3.235]	1.480*	[1.044,2.097]	1.88	[0.924,3.823]	
Sick in past 2 weeks	0.915	[0.634,1.321]	0.957	[0.772,1.186]	1.145	[0.769,1.705]		
Maternal characteristics	Age	15-19 years	1	(ref)	1	(ref)	1	(ref)
		20-34 years	0.53	[0.193,1.461]	0.663*	[0.471,0.934]	0.326**	[0.152,0.697]
		35-49 years	0.423	[0.152,1.179]	0.577**	[0.385,0.863]	0.194**	[0.0694,0.541]
	Parity	1 child	1	(ref)	1	(ref)	1	(ref)
		2-3 children	1.513	[0.705,3.243]	1.118	[0.875,1.429]	0.77	[0.438,1.355]
		4-5 children	2.461*	[1.148,5.273]	1.242	[0.931,1.659]	1.884	[0.900,3.945]
		6 or more children	2.835*	[1.107,7.261]	1.211	[0.835,1.755]	3.259**	[1.366,7.774]
	Marital status	Married or in union	1	(ref)	1	(ref)	1	(ref)
		Single	0.984	[0.534,1.815]	1.004	[0.701,1.438]	0.786	[0.422,1.465]
		Divorced, separated, widowed, other	1.51	[0.748,3.049]	1.292	[0.878,1.903]	1.56	[0.515,4.722]
	Education	None	1	(ref)	1	(ref)	1	(ref)
		Primary	0.747	[0.458,1.216]	0.599***	[0.489,0.734]	0.73	[0.424,1.255]
		Secondary or more	0.711	[0.397,1.276]	0.470***	[0.318,0.697]	0.384	[0.144,1.022]
Literate	0.467**	[0.270,0.808]	0.953	[0.745,1.218]	1.215	[0.850,1.736]		
Occupational status ^b	Homemaker			1	(ref)	1	(ref)	
	Employed			0.409**	[0.222,0.755]	1.267	[0.579,2.776]	
	Student, working without pay, other			0.845	[0.521,1.373]	0.389	[0.0483,3.130]	
Household and community characteristics	Household expenditure quintile	1	1	(ref)	1	(ref)	1	(ref)
		2	1.207	[0.662,2.201]	1.058	[0.799,1.402]	0.471**	[0.278,0.798]
		3	0.597	[0.315,1.130]	1.251	[0.990,1.582]	0.444**	[0.261,0.755]
		4	0.542	[0.227,1.292]	0.88	[0.668,1.160]	0.452*	[0.226,0.907]
		5	0.677	[0.325,1.412]	0.848	[0.651,1.103]	0.415*	[0.192,0.895]
	Asset index			0.299**	[0.125,0.714]	0.00849***	[0.000812,0.0887]	
	Household size			1.058***	[1.025,1.093]	1.103	[0.985,1.234]	
	Urban ^c			0.779	[0.519,1.169]	0.759	[0.458,1.257]	
	Female head of household			0.941	[0.714,1.240]	0.982	[0.492,1.959]	
	Indigenous household ^d			1.219	[0.955,1.557]			

		Mexico (N=5,159)		Nicaragua (N=1,916)		Panama (N=1,460)		
		OR	95% CI	OR	95% CI	OR	95% CI	
Child characteristics	Female	0.921	[0.735,1.154]	0.567	[0.291,1.107]	0.722*	[0.551,0.945]	
	Age	0-11 months	1	(ref)	1	(ref)	1	(ref)
		12-23 months	2.817***	[1.600,4.959]	25.10**	[2.718,231.7]	2.472***	[1.626,3.761]
		24-35 months	4.840***	[2.689,8.712]	73.76***	[7.585,717.3]	2.481**	[1.397,4.409]
		36-47 months	5.093***	[2.865,9.056]	56.12***	[5.966,527.9]	1.314	[0.801,2.155]
		48-59 months	4.307***	[2.370,7.828]	47.66***	[5.402,420.5]	1.23	[0.636,2.376]
	Low birth weight	1.599	[0.875,2.921]	1.356	[0.694,2.653]	1.163	[0.446,3.036]	
Sick in past 2 weeks	0.9	[0.728,1.112]	2.068*	[1.142,3.745]	1.174	[0.813,1.694]		
Maternal characteristics	Age	15-19 years	1	(ref)	1	(ref)	1	(ref)
		20-34 years	0.79	[0.533,1.170]	0.326	[0.0977,1.088]	1.482	[0.816,2.691]
		35-49 years	0.651	[0.397,1.065]	0.180*	[0.0432,0.747]	1.061	[0.500,2.252]
	Parity	1 child	1	(ref)	1	(ref)	1	(ref)
		2-3 children	1.504*	[1.050,2.155]	2.364*	[1.030,5.426]	0.898	[0.589,1.370]
		4-5 children	2.141***	[1.440,3.183]	1.757	[0.619,4.983]	1.117	[0.615,2.029]
		6 or more children	2.477***	[1.505,4.078]	2.676	[0.660,10.84]	1.447	[0.791,2.649]
	Marital status	Married or in union	1	(ref)	1	(ref)	1	(ref)
		Single	0.591	[0.241,1.449]	1.259	[0.675,2.349]	1.897**	[1.193,3.017]
		Divorced, separated, widowed, other	1.178	[0.633,2.191]	1.016	[0.218,4.741]	0.779	[0.433,1.402]
	Education	None	1	(ref)	1	(ref)	1	(ref)
		Primary	0.776	[0.586,1.027]	0.843	[0.346,2.055]	0.530*	[0.297,0.945]
	Literate	Secondary or more	0.482**	[0.309,0.751]	0.765	[0.249,2.349]	0.483*	[0.242,0.962]
Literate		0.914	[0.702,1.190]	0.402*	[0.178,0.908]	0.985	[0.685,1.419]	
Occupational status ^b	Homemaker	1	(ref)			1	(ref)	
	Employed	1.295	[0.438,3.827]			0.889	[0.388,2.038]	
	Student, working without pay, other	1.578	[0.737,3.382]			0.476	[0.173,1.311]	
Household and community characteristics	Household expenditure quintile	1	1	(ref)	1	(ref)	1	(ref)
		2	0.786	[0.574,1.076]	0.469	[0.170,1.293]	0.602*	[0.371,0.978]
		3	0.590***	[0.440,0.790]	0.505	[0.165,1.548]	0.629*	[0.427,0.927]
		4	0.761	[0.514,1.127]	0.635	[0.232,1.736]	0.584*	[0.384,0.888]
		5	0.554*	[0.323,0.951]	0.594	[0.227,1.552]	0.500**	[0.305,0.822]
	Asset index	0.311	[0.0790,1.226]	0.0108***	[0.000890,0.131]	0.0390***	[0.00924,0.165]	
	Household size	0.997	[0.936,1.063]	1.183***	[1.083,1.292]	1.052**	[1.013,1.093]	
	Urban ^c	0.644*	[0.428,0.969]	0.504	[0.154,1.653]			
	Female head of household	0.95	[0.510,1.769]	1.918	[0.907,4.055]	0.976	[0.599,1.591]	
	Indigenous household ^d	2.278***	[1.458,3.560]	7.199***	[2.377,21.80]			

*p-value<0.05 **p-value <0.01 ***p-value <0.001

^aMultivariable analysis is adjusted for all variables in column.

^bMother's occupational status was not included in the stratified regression for El Salvador or Nicaragua, due to correlation with the outcome.

^cAll households in Panama were in rural areas, so this variable was not included in the stratified regression for this country.

^dAll households in El Salvador were non-indigenous, and all households in Panama were indigenous, so this variable was not included in the stratified regression for these countries. Very few households in Honduras were indigenous, so this variable was not included in the stratified regression for this country.

Table A9. Country-stratified analysis of individual, maternal, and household correlates of underweight, among children 0-59 months^a.

		El Salvador (N=2,892)		Guatemala (N=4,155)		Honduras (N=2,368)		
		OR	95% CI	OR	95% CI	OR	95% CI	
Child characteristics	Female	0.982	[0.649,1.487]	0.512***	[0.397,0.661]	0.434**	[0.231,0.815]	
	Age	0-11 months	1	(ref)	1	(ref)	1	(ref)
		12-23 months	1.491	[0.649,3.427]	1.915***	[1.363,2.691]	2.076	[0.664,6.492]
		24-35 months	0.677	[0.282,1.627]	2.254***	[1.570,3.236]	3.371*	[1.071,10.61]
		36-47 months	1.301	[0.587,2.884]	1.633*	[1.094,2.440]	3.231*	[1.250,8.352]
		48-59 months	1.263	[0.601,2.655]	1.133	[0.721,1.781]	2.329	[0.711,7.636]
	Low birth weight	2.233**	[1.347,3.703]	2.588***	[1.720,3.895]	1.41	[0.641,3.098]	
Sick in past 2 weeks	1.078	[0.677,1.716]	1.353*	[1.018,1.799]	1.600*	[1.016,2.520]		
Maternal characteristics	Age	15-19 years	1	(ref)	1	(ref)	1	(ref)
		20-34 years	0.671	[0.303,1.489]	0.964	[0.549,1.692]	0.557	[0.223,1.394]
		35-49 years	0.796	[0.321,1.972]	0.61	[0.321,1.158]	0.673	[0.230,1.965]
	Parity	1 child	1	(ref)	1	(ref)	1	(ref)
		2-3 children	1.546	[0.789,3.029]	1.061	[0.705,1.595]	0.92	[0.483,1.754]
		4-5 children	1.959*	[1.005,3.818]	1.113	[0.723,1.714]	1.939	[0.725,5.186]
		6 or more children	2.312*	[1.042,5.130]	1.171	[0.712,1.924]	1.651	[0.762,3.580]
	Marital status ^b	Married or in union	1	(ref)	1	(ref)	1	(ref)
		Single	1.273	[0.681,2.380]	0.82	[0.492,1.368]	1.158	[0.548,2.447]
		Divorced, separated, widowed, other	1.617	[0.793,3.295]	1.746	[0.934,3.267]	1.497	[0.468,4.787]
	Education	None	1	(ref)	1	(ref)	1	(ref)
		Primary	0.886	[0.511,1.535]	0.725*	[0.567,0.927]	0.308**	[0.149,0.635]
	Literate	Secondary or more	0.742	[0.368,1.496]	0.536	[0.285,1.007]	0.239*	[0.0774,0.738]
Literate		0.601*	[0.383,0.944]	0.669	[0.439,1.020]	2.006*	[1.086,3.706]	
Occupational status ^c	Homemaker	1	(ref)					
	Employed	0.337	[0.0927,1.225]					
	Student, working without pay, other	1.192	[0.358,3.966]					
Household and community characteristics	Household expenditure quintile	1	1	(ref)	1	(ref)	1	(ref)
		2	0.916	[0.559,1.501]	0.888	[0.616,1.280]	0.559*	[0.315,0.991]
		3	0.444**	[0.259,0.761]	0.861	[0.607,1.221]	0.276**	[0.107,0.712]
		4	0.554	[0.289,1.059]	0.896	[0.625,1.287]	0.387*	[0.170,0.884]
		5	0.475	[0.225,1.003]	0.776	[0.509,1.183]	0.562	[0.253,1.250]
	Asset index	0.399	[0.107,1.485]	0.571	[0.140,2.330]	0.0532	[0.00123,2.305]	
	Household size	1.139*	[1.014,1.280]	1.053*	[1.005,1.103]	1.051	[0.907,1.217]	
	Urban ^d	0.453*	[0.207,0.994]	0.929	[0.588,1.467]	0.884	[0.477,1.640]	
	Female head of household	0.709	[0.425,1.181]	0.446*	[0.233,0.855]	0.839	[0.380,1.855]	
	Indigenous household ^e			1.051	[0.763,1.446]			

		Mexico (N=5,160)		Nicaragua (N=1,914)		Panama (N=1,462)		
		OR	95% CI	OR	95% CI	OR	95% CI	
Child characteristics	Female	0.464***	[0.309,0.696]	1.152	[0.707,1.878]	0.577*	[0.367,0.907]	
	Age	0-11 months	1	(ref)	1	(ref)	1	(ref)
		12-23 months	1.658	[0.965,2.847]	1.187	[0.146,9.638]	1.621	[0.917,2.866]
		24-35 months	1.761	[0.995,3.119]	9.122**	[2.395,34.74]	0.873	[0.438,1.742]
		36-47 months	1.471	[0.816,2.653]	6.001*	[1.485,24.25]	0.443*	[0.223,0.880]
		48-59 months	1.193	[0.602,2.362]	4.747	[0.919,24.51]	0.489	[0.179,1.340]
	Low birth weight	2.320*	[1.180,4.563]	3.273*	[1.321,8.111]	1.451	[0.424,4.958]	
Sick in past 2 weeks	1.277	[0.832,1.960]	1.903	[0.971,3.730]	1.671*	[1.039,2.687]		
Maternal characteristics	Age	15-19 years	1	(ref)	1	(ref)	1	(ref)
		20-34 years	0.706	[0.329,1.511]	0.269*	[0.0790,0.914]	1.352	[0.382,4.788]
		35-49 years	0.606	[0.265,1.388]	0.328	[0.0693,1.548]	0.746	[0.159,3.498]
	Parity	1 child	1	(ref)	1	(ref)	1	(ref)
		2-3 children	1.776	[0.896,3.518]	0.931	[0.376,2.307]	1.991	[0.982,4.039]
		4-5 children	2.014	[0.916,4.427]	0.893	[0.192,4.140]	2.445*	[1.130,5.290]
		6 or more children	3.225**	[1.329,7.826]	0.295	[0.0240,3.628]	2.621*	[1.070,6.419]
	Marital status ^b	Married or in union	1	(ref)	1	(ref)	1	(ref)
		Single			1.174	[0.469,2.936]	1.602	[0.771,3.330]
		Divorced, separated, widowed, other			2.427	[0.300,19.63]	1.515	[0.728,3.153]
	Education	None	1	(ref)	1	(ref)	1	(ref)
Primary		1	[1,1]	0.456	[0.118,1.759]	0.632	[0.285,1.399]	
Secondary or more		0.787	[0.243,2.553]	1.086	[0.154,7.632]	0.687	[0.263,1.795]	
Literate	0.915	[0.136,6.147]	0.243**	[0.0920,0.642]	0.73	[0.460,1.160]		
Occupational status ^c	Homemaker	1	(ref)	1	(ref)	1	(ref)	
	Employed			0.402	[0.103,1.566]	0.24	[0.0255,2.252]	
	Student, working without pay, other			1.156	[0.274,4.882]	0.426	[0.0557,3.256]	
Household and community characteristics	Household expenditure quintile	1	1	(ref)	1	(ref)	1	(ref)
		2	1.054	[0.589,1.885]	0.673	[0.287,1.576]	1.475	[0.935,2.327]
		3	0.540*	[0.310,0.941]	0.156	[0.0225,1.079]	0.721	[0.388,1.340]
		4	0.792	[0.459,1.365]	0.0279**	[0.00281,0.277]	0.737	[0.411,1.323]
		5	0.802	[0.386,1.666]	0.4	[0.0838,1.906]	0.963	[0.518,1.789]
	Asset index	1.219	[0.194,7.646]	1.338	[0.0341,52.52]	0.0140**	[0.000958,0.204]	
	Household size	1.006	[0.896,1.130]	1.037	[0.863,1.246]	1.059*	[1.012,1.107]	
	Urban ^d	0.858	[0.566,1.303]	0.959	[0.189,4.871]			
	Female head of household	1.089	[0.479,2.479]	0.672	[0.259,1.738]	0.937	[0.502,1.749]	
	Indigenous household ^e	1.943*	[1.127,3.349]	7.632*	[1.334,43.65]			

*p-value<0.05 **p-value <0.01 ***p-value <0.001

^aMultivariable analysis is adjusted for all variables in column.

^bMother's marital status was not included in the stratified regression for Mexico, due to correlation with the outcome.

^cMother's occupational status was not included in the stratified regression for El Salvador Guatemala, or Mexico, due to correlation with the outcome.

^dAll households in Panama were in rural areas, so this variable was not included in the stratified regression for this country.

^eAll households in El Salvador were non-indigenous, and all households in Panama were indigenous, so this variable was not included in the stratified regression for these countries. Very few households in Honduras were indigenous, so this variable was not included in the stratified regression for this country.

Table A10. Country-stratified analysis of individual, maternal, and household correlates of wasting, among children 0-59 months^a.

		El Salvador (N=2,888)		Guatemala (N=4,139)		Honduras (N=2,377)		
		OR	95% CI	OR	95% CI	OR	95% CI	
Child characteristics	Female	0.731	[0.466,1.144]	0.826	[0.430,1.586]	0.377*	[0.149,0.954]	
	Age	0-11 months	1	(ref)	1	(ref)	1	(ref)
		12-23 months	0.458*	[0.237,0.885]	0.877	[0.356,2.160]	2.305	[0.733,7.250]
		24-35 months	0.205**	[0.0777,0.541]	0.535	[0.229,1.251]	1.012	[0.163,6.299]
		36-47 months	0.308**	[0.146,0.649]	0.0589**	[0.00715,0.484]	1.459	[0.235,9.071]
		48-59 months	0.203***	[0.0851,0.486]	0.305	[0.0603,1.547]	2.1	[0.376,11.75]
	Low birth weight	1.466	[0.695,3.092]	2.257	[0.806,6.326]	0.694	[0.0664,7.248]	
Sick in past 2 weeks	1.509	[0.811,2.811]	0.972	[0.450,2.101]	3.427*	[1.155,10.17]		
Maternal characteristics	Age	15-19 years	1	(ref)	1	(ref)	1	(ref)
		20-34 years	1.776	[0.690,4.570]	2.712*	[1.032,7.124]	0.168	[0.0261,1.088]
		35-49 years	2.57	[0.830,7.962]	1.043	[0.236,4.608]	1.724	[0.236,12.62]
	Parity ^b	1 child	1	(ref)	1	(ref)	1	(ref)
		2-3 children	1.244	[0.635,2.433]	0.82	[0.359,1.874]	0.875	[0.253,3.027]
		4-5 children	0.864	[0.342,2.178]	0.715	[0.235,2.174]	1.447	[0.438,4.773]
		6 or more children	0.901	[0.373,2.177]	0.462	[0.157,1.359]	0.483	[0.0758,3.073]
	Marital status ^c	Married or in union	1	(ref)	1	(ref)	1	(ref)
		Single	1.003	[0.452,2.227]	0.94	[0.215,4.112]	2.209	[0.371,13.14]
		Divorced, separated, widowed, other	1.034	[0.375,2.853]	2.726	[0.869,8.556]	7.950*	[1.223,51.68]
	Education ^d	None	1	(ref)	1	(ref)	1	[1,1]
		Primary	1.32	[0.683,2.551]	1.381	[0.662,2.884]	0.39	[0.0848,1.793]
	Literate	Secondary or more	1.223	[0.471,3.178]	0.348	[0.0618,1.961]	^d	
Literate		1.094	[0.484,2.469]	0.698	[0.262,1.861]	1.584	[0.485,5.180]	
Occupational status ^e	Homemaker	1	(ref)					
	Employed	0.699	[0.169,2.888]					
	Student, working without pay, other	1.51	[0.338,6.745]					
	Occupational status ^e							
Household and community characteristics	Household expenditure quintile	1	1	(ref)	1	(ref)	1	(ref)
		2	1.004	[0.485,2.079]	1.258	[0.474,3.339]	0.715	[0.164,3.124]
		3	0.642	[0.273,1.508]	0.599	[0.206,1.743]	0.609	[0.135,2.743]
		4	1.089	[0.463,2.558]	0.99	[0.359,2.728]	0.363	[0.0711,1.854]
		5	0.875	[0.372,2.059]	0.645	[0.194,2.149]	0.449	[0.102,1.985]
	Asset index	0.169	[0.0238,1.199]	5.26	[0.262,105.8]	0.278	[0.000395,196.0]	
	Household size	1.037	[0.875,1.229]	0.987	[0.886,1.099]	1.117	[0.879,1.420]	
	Urban ^f	0.809	[0.382,1.717]	1.111	[0.295,4.179]	0.291	[0.0394,2.155]	
	Female head of household	0.671	[0.339,1.329]	0.621	[0.198,1.946]	0.368	[0.0569,2.384]	
	Indigenous household ^g			0.591	[0.285,1.227]			

		Mexico (N=5,142)		Nicaragua (N=1,913)		Panama (N=1,460)		
		OR	95% CI	OR	95% CI	OR	95% CI	
Child characteristics	Female	0.379*	[0.153,0.941]	0.983	[0.259,3.726]	1.056	[0.367,3.038]	
	Age	0-11 months	1	(ref)	1	(ref)	1	(ref)
		12-23 months	1.498	[0.630,3.559]	0.534	[0.121,2.360]	0.962	[0.349,2.653]
		24-35 months	0.462	[0.159,1.338]	0.305	[0.0611,1.521]	0.366	[0.0980,1.368]
		36-47 months	0.157*	[0.0321,0.769]	0.435	[0.105,1.802]	0.162*	[0.0304,0.867]
		48-59 months	0.554	[0.137,2.244]	0.161	[0.0163,1.601]	0.276	[0.0292,2.608]
	Low birth weight	2.713*	[1.114,6.605]	2.866	[0.899,9.143]	2.013	[0.164,24.68]	
Sick in past 2 weeks	1.438	[0.736,2.811]	1.802	[0.677,4.798]	2.418	[0.896,6.524]		
Maternal characteristics	Age	15-19 years	1	(ref)	1	(ref)	1	(ref)
		20-34 years	9.691*	[1.204,77.99]	0.641	[0.141,2.911]	1.144	[0.216,6.076]
		35-49 years	11.00*	[1.113,108.8]	1.162	[0.151,8.969]	0.945	[0.114,7.821]
	Parity ^b	1 child	1	(ref)	1	(ref)	1	(ref)
		2-3 children	0.898	[0.309,2.615]	0.875	[0.222,3.450]	8.851	[0.943,83.07]
		4-5 children	1.013	[0.459,2.233]	0.127	[0.0115,1.407]	3.111	[0.263,36.76]
		6 or more children	0.828	[0.200,3.425]	^b		10.96	[0.948,126.7]
	Marital status ^c	Married or in union			1	(ref)		
		Single			0.916	[0.249,3.377]		
		Divorced, separated, widowed, other			1.958	[0.182,21.10]		
	Education ^d	None	1	(ref)	1	(ref)	1	(ref)
Primary		0.782	[0.274,2.232]	0.438	[0.0594,3.233]	0.756	[0.258,2.215]	
Secondary or more		0.927	[0.302,2.846]	0.146	[0.0122,1.749]	2.111	[0.611,7.293]	
Literate	0.823	[0.349,1.938]	0.934	[0.249,3.494]	0.181**	[0.0594,0.551]		
Occupational status ^e	Homemaker			1	(ref)			
	Employed			1.766	[0.419,7.444]			
	Student, working without pay, other			5.711*	[1.175,27.75]			
Household and community characteristics	Household expenditure quintile	1	1	(ref)	1	(ref)	1	(ref)
		2	1.582	[0.465,5.376]	2.882	[0.729,11.40]	3.839	[0.911,16.17]
		3	0.943	[0.374,2.379]	1.077	[0.120,9.693]	2.053	[0.597,7.056]
		4	1.107	[0.279,4.395]	0.364	[0.0603,2.201]	2.047	[0.501,8.358]
		5	1.607	[0.405,6.378]	0.202	[0.0216,1.897]	0.302	[0.0315,2.891]
	Asset index	0.86	[0.0231,31.97]	163.3*	[2.412,11048.2]	0.154	[0.00566,4.163]	
	Household size	1.002	[0.814,1.233]	0.926	[0.801,1.072]	1.012	[0.892,1.149]	
	Urban ^f	0.917	[0.336,2.501]	1.726	[0.632,4.717]			
	Female head of household	1.65	[0.367,7.410]	0.863	[0.239,3.111]	1.227	[0.510,2.950]	
Indigenous household ^g	0.834	[0.323,2.157]	1.447	[0.414,5.053]				

*p-value<0.05 **p-value <0.01 ***p-value <0.001

^aMultivariable analysis is adjusted for all variables in column.

^bMaternal parity categories was classified as one, two to three, or four or more for Nicaragua only.

^cMother's marital status was not included in the stratified regression for Mexico or Panama , due to correlation with the outcome.

^dMaternal education categories were classified as none or primary or more schooling for Honduras only.

^eMother's occupational status was not included in the stratified regression for Guatemala, Honduras, Mexico, or Panama due to correlation with the outcome.

^fAll households in Panama were in rural areas, so this variable was not included in the stratified regression for this country.

^gAll households in El Salvador were non-indigenous, and all households in Panama were indigenous, so this variable was not included in the stratified regression for these countries. Very few households in Honduras were indigenous, so this variable was not included in the stratified regression for this country.

Table A11. Country-stratified analysis of individual, maternal, and household correlates of overweight, among children 0-59 months^a.

		El Salvador (N=2,888)		Guatemala (N=4,139)		Honduras (N=2,377)		
		OR	95% CI	OR	95% CI	OR	95% CI	
Child characteristics	Female	0.795	[0.555,1.137]	0.855	[0.642,1.137]	1.319	[0.899,1.935]	
	Age	0-11 months	1	(ref)	1	(ref)	1	(ref)
		12-23 months	0.826	[0.490,1.393]	0.301***	[0.188,0.483]	0.393***	[0.243,0.633]
		24-35 months	0.72	[0.419,1.237]	0.198***	[0.114,0.343]	0.227***	[0.132,0.390]
		36-47 months	1.174	[0.713,1.933]	0.368***	[0.232,0.584]	0.188***	[0.0873,0.405]
		48-59 months	0.886	[0.542,1.448]	0.210***	[0.119,0.371]	0.189***	[0.0875,0.408]
	Low birth weight	1.16	[0.722,1.865]	0.747	[0.352,1.587]	0.43	[0.147,1.258]	
Sick in past 2 weeks	0.893	[0.627,1.273]	0.437***	[0.279,0.686]	0.889	[0.575,1.375]		
Maternal characteristics	Age	15-19 years	1	(ref)	1	(ref)	1	(ref)
		20-34 years	1.295	[0.665,2.521]	1.087	[0.637,1.856]	0.989	[0.503,1.942]
		35-49 years	1.447	[0.579,3.616]	0.905	[0.433,1.891]	1.027	[0.401,2.629]
	Parity	1 child	1	(ref)	1	(ref)	1	(ref)
		2-3 children	0.956	[0.618,1.479]	0.982	[0.626,1.542]	1.318	[0.805,2.158]
		4-5 children	0.611	[0.320,1.169]	0.942	[0.499,1.781]	1	[0.460,2.172]
		6 or more children	0.404	[0.162,1.007]	1.002	[0.486,2.064]	0.658	[0.320,1.355]
	Marital status	Married or in union	1	(ref)	1	(ref)	1	(ref)
		Single	0.751	[0.401,1.407]	0.925	[0.499,1.714]	1.503	[0.854,2.643]
		Divorced, separated, widowed, other	0.776	[0.370,1.629]	1.478	[0.692,3.159]	1.204	[0.321,4.519]
	Education	None	1	(ref)	1	(ref)	1	(ref)
		Primary	0.997	[0.478,2.080]	0.904	[0.573,1.429]	0.758	[0.314,1.830]
		Secondary or more	1.481	[0.646,3.392]	1.542	[0.809,2.939]	0.64	[0.232,1.764]
	Literate	0.822	[0.520,1.299]	0.77	[0.526,1.127]	1	[0.607,1.646]	
Occupational status	Homemaker	1	(ref)	1	(ref)	1	(ref)	
	Employed	0.698	[0.378,1.290]	1.305	[0.583,2.925]	1.084	[0.538,2.184]	
	Student, working without pay, other	1.08	[0.427,2.736]	0.829	[0.259,2.660]	1.651	[0.530,5.141]	
Household and community characteristics	Household expenditure quintile	1	1	(ref)	1	(ref)	1	(ref)
		2	1.261	[0.667,2.384]	0.607	[0.341,1.081]	0.953	[0.477,1.906]
		3	1.746	[0.982,3.102]	1.26	[0.803,1.979]	1.321	[0.610,2.862]
		4	1.746	[0.927,3.287]	1.084	[0.639,1.840]	0.961	[0.488,1.891]
		5	2.965***	[1.609,5.461]	1.025	[0.617,1.703]	1.614	[0.803,3.246]
	Asset index	2.119	[0.658,6.826]	0.869	[0.162,4.666]	0.786	[0.121,5.094]	
	Household size	0.976	[0.840,1.134]	1.032	[0.985,1.081]	0.959	[0.840,1.095]	
	Urban ^b	1.23	[0.858,1.764]	1.02	[0.658,1.582]	0.894	[0.482,1.660]	
	Female head of household	0.79	[0.500,1.247]	0.83	[0.493,1.396]	1.265	[0.823,1.945]	
	Indigenous household ^c			0.763	[0.497,1.171]			

		Mexico (N=5,142)		Nicaragua (N=1,913)		Panama (N=1,406)		
		OR	95% CI	OR	95% CI	OR	95% CI	
Child characteristics	Female	0.723**	[0.567,0.922]	0.828	[0.530,1.294]	0.753	[0.411,1.377]	
	Age	0-11 months	1	(ref)	1	(ref)	1	(ref)
		12-23 months	0.269***	[0.176,0.410]	1.286	[0.634,2.611]	0.482*	[0.236,0.982]
		24-35 months	0.372***	[0.246,0.564]	0.699	[0.361,1.353]	0.417	[0.170,1.025]
		36-47 months	0.386***	[0.260,0.574]	0.857	[0.507,1.449]	0.108**	[0.0284,0.410]
		48-59 months	0.337***	[0.211,0.538]	0.944	[0.529,1.685]	0.438	[0.142,1.353]
	Low birth weight	0.652	[0.311,1.368]	1.111	[0.595,2.076]	1	[1,1]	
Sick in past 2 weeks	0.899	[0.694,1.163]	0.726	[0.476,1.107]	2.153*	[1.121,4.135]		
Maternal characteristics	Age	15-19 years	1	(ref)	1	(ref)	1	(ref)
		20-34 years	0.996	[0.623,1.590]	1.02	[0.564,1.842]	0.785	[0.269,2.291]
		35-49 years	1.222	[0.612,2.439]	1.065	[0.448,2.531]	0.384	[0.102,1.440]
	Parity	1 child	1	(ref)	1	(ref)	1	(ref)
		2-3 children	0.895	[0.615,1.302]	0.98	[0.579,1.660]	3.42	[0.916,12.77]
		4-5 children	1.086	[0.647,1.824]	0.502	[0.213,1.182]	3.563	[0.863,14.70]
		6 or more children	1.459	[0.766,2.781]	1.068	[0.402,2.832]	1.91	[0.356,10.25]
	Marital status	Married or in union	1	(ref)	1	(ref)	1	(ref)
		Single	1.578	[0.546,4.563]	0.649	[0.373,1.129]	1.208	[0.331,4.418]
		Divorced, separated, widowed, other	2.122*	[1.089,4.137]	1.723	[0.899,3.303]	0.931	[0.274,3.162]
	Education	None	1	(ref)	1	(ref)	1	(ref)
		Primary	1.121	[0.756,1.661]	0.961	[0.486,1.901]	0.855	[0.376,1.948]
		Secondary or more	1.385	[0.867,2.212]	1.929	[0.878,4.237]	0.944	[0.322,2.769]
Literate	0.866	[0.634,1.184]	0.74	[0.452,1.209]	0.928	[0.400,2.152]		
Occupational status	Homemaker	1	(ref)	1	(ref)	1	(ref)	
	Employed	1.108	[0.489,2.507]	0.684	[0.352,1.328]	2.092	[0.540,8.101]	
	Student, working without pay, other	1.336	[0.563,3.168]	0.406	[0.0516,3.197]	1.753	[0.267,11.50]	
Household and community characteristics	Household expenditure quintile	1	1	(ref)	1	(ref)	1	(ref)
		2	0.907	[0.619,1.330]	1.488	[0.627,3.529]	2.639	[0.786,8.861]
		3	1.27	[0.879,1.836]	1.863	[0.828,4.194]	1.159	[0.265,5.076]
		4	0.923	[0.606,1.407]	1.753	[0.818,3.756]	2.124	[0.547,8.257]
		5	1.232	[0.813,1.867]	2.395*	[1.095,5.239]	3.007	[0.838,10.79]
	Asset index	2.888	[0.636,13.11]	1.085	[0.153,7.678]	4.021	[0.243,66.41]	
	Household size	0.96	[0.893,1.032]	0.969	[0.882,1.064]	0.992	[0.914,1.077]	
	Urban ^b	1.15	[0.842,1.571]	0.447**	[0.261,0.766]			
	Female head of household	0.512*	[0.267,0.980]	0.805	[0.544,1.192]	0.814	[0.370,1.791]	
	Indigenous household ^c	0.818	[0.596,1.123]	0.514	[0.249,1.061]			

*p-value<0.05 **p-value <0.01 ***p-value <0.001

^aMultivariable analysis is adjusted for all variables in column.

^bAll households in Panama were in rural areas, so this variable was not included in the stratified regression for this country.

^cAll households in El Salvador were non-indigenous, and all households in Panama were indigenous, so this variable was not included in the stratified regression for these countries. Very few households in Honduras were indigenous, so this variable was not included in the stratified regression for this country.

Table A12. Country-stratified analysis of individual, maternal, and household correlates of anemia, among children 6-59 months^a.

		El Salvador (N=2,641)		Guatemala (N=3,251)		Honduras (N=2,029)		
		OR	95% CI	OR	95% CI	OR	95% CI	
Child characteristics	Female	0.767**	[0.638,0.922]	0.85	[0.719,1.006]	0.723**	[0.580,0.902]	
	Age	6-11 months	1	(ref)	1	(ref)	1	(ref)
		12-23 months	0.412***	[0.305,0.555]	0.611***	[0.473,0.790]	0.640*	[0.447,0.918]
		24-35 months	0.194***	[0.137,0.275]	0.415***	[0.317,0.544]	0.335***	[0.237,0.472]
		36-47 months	0.142***	[0.0966,0.209]	0.328***	[0.247,0.434]	0.223***	[0.151,0.330]
		48-59 months	0.117***	[0.0758,0.179]	0.253***	[0.189,0.340]	0.212***	[0.138,0.326]
	Low birth weight	1.039	[0.764,1.412]	1.309	[0.969,1.768]	0.636*	[0.406,0.998]	
Sick in past 2 weeks	1.052	[0.857,1.291]	1.341**	[1.087,1.655]	1.028	[0.814,1.296]		
Maternal characteristics	Age	15-19 years	1	(ref)	1	(ref)	1	(ref)
		20-34 years	0.871	[0.597,1.270]	0.705*	[0.514,0.966]	0.751	[0.486,1.163]
		35-49 years	0.869	[0.533,1.414]	0.514***	[0.348,0.760]	0.652	[0.383,1.108]
	Parity	1 child	1	(ref)	1	(ref)	1	(ref)
		2-3 children	1.079	[0.808,1.441]	1.341*	[1.062,1.693]	1.258	[0.907,1.745]
		4-5 children	0.974	[0.727,1.305]	1.248	[0.928,1.679]	1.433	[0.954,2.153]
		6 or more children	1.053	[0.669,1.659]	1.712**	[1.229,2.387]	1.163	[0.735,1.839]
	Marital status	Married or in union	1	(ref)	1	(ref)	1	(ref)
		Single	1.117	[0.785,1.588]	1.035	[0.779,1.375]	1.247	[0.872,1.781]
		Divorced, separated, widowed, other	1.134	[0.735,1.749]	1.549*	[1.091,2.200]	1.655	[0.932,2.938]
	Education	None	1	(ref)	1	(ref)	1	(ref)
		Primary	0.972	[0.671,1.409]	0.738**	[0.591,0.921]	0.681	[0.451,1.029]
		Secondary or more	0.813	[0.539,1.227]	0.989	[0.676,1.445]	0.92	[0.518,1.633]
Literate	1.018	[0.772,1.342]	1.073	[0.854,1.349]	1.099	[0.817,1.478]		
Occupational status	Homemaker	1	(ref)	1	(ref)	1	(ref)	
	Employed	0.808	[0.586,1.116]	0.77	[0.506,1.172]	0.913	[0.568,1.469]	
	Student, working without pay, other	0.981	[0.472,2.041]	0.403***	[0.249,0.654]	0.633	[0.312,1.286]	
Household and community characteristics	Household expenditure quintile	1	1	(ref)	1	(ref)	1	(ref)
		2	1.13	[0.855,1.495]	1.142	[0.858,1.519]	1.194	[0.831,1.715]
		3	1.081	[0.798,1.465]	1.378*	[1.017,1.867]	1.025	[0.697,1.507]
		4	0.927	[0.648,1.326]	1.347	[0.999,1.816]	0.962	[0.668,1.386]
		5	1.103	[0.782,1.555]	1.068	[0.781,1.460]	1.06	[0.700,1.606]
	Asset index	0.79	[0.403,1.549]	1.65	[0.615,4.427]	0.199*	[0.0583,0.682]	
	Household size	1.023	[0.953,1.099]	1.022	[0.992,1.053]	1.003	[0.947,1.062]	
	Urban ^b	0.651**	[0.483,0.878]	0.782	[0.467,1.311]	0.931	[0.534,1.622]	
	Female head of household	1.189	[0.916,1.543]	0.79	[0.612,1.020]	0.963	[0.678,1.367]	
	Indigenous household ^c			1.376	[0.982,1.928]			

		Mexico (N=4,498)		Nicaragua (N=1,686)		Panama (N=937)		
		OR	95% CI	OR	95% CI	OR	95% CI	
Child characteristics	Female	0.928	[0.794,1.084]	0.939	[0.752,1.172]	0.848	[0.644,1.116]	
	Age	6-11 months	1	(ref)	1	(ref)	1	(ref)
		12-23 months	0.390***	[0.312,0.487]	0.487***	[0.323,0.736]	0.519	[0.252,1.070]
		24-35 months	0.255***	[0.195,0.334]	0.329***	[0.216,0.500]	0.311**	[0.150,0.645]
		36-47 months	0.220***	[0.164,0.295]	0.243***	[0.164,0.359]	0.135***	[0.0625,0.291]
		48-59 months	0.194***	[0.144,0.261]	0.179***	[0.116,0.275]	0.154***	[0.0756,0.315]
	Low birth weight	0.823	[0.565,1.199]	0.67	[0.438,1.025]	0.606	[0.319,1.150]	
Sick in past 2 weeks	1.151	[0.967,1.370]	1.224	[0.956,1.568]	1.432	[0.907,2.261]		
Maternal characteristics	Age	15-19 years	1	(ref)	1	(ref)	1	(ref)
		20-34 years	1.042	[0.767,1.415]	0.904	[0.612,1.334]	0.986	[0.587,1.657]
		35-49 years	0.811	[0.550,1.198]	0.933	[0.518,1.679]	0.817	[0.431,1.551]
	Parity	1 child	1	(ref)	1	(ref)	1	(ref)
		2-3 children	1.051	[0.812,1.360]	0.945	[0.710,1.259]	0.799	[0.504,1.266]
		4-5 children	1.418*	[1.046,1.923]	0.938	[0.627,1.404]	0.851	[0.500,1.450]
		6 or more children	1.136	[0.710,1.819]	0.571	[0.271,1.204]	0.909	[0.461,1.791]
	Marital status	Married or in union	1	(ref)	1	(ref)	1	(ref)
		Single	1.24	[0.625,2.462]	1.08	[0.729,1.600]	0.705	[0.358,1.391]
		Divorced, separated, widowed, other	1.315	[0.874,1.978]	0.944	[0.517,1.724]	1.016	[0.502,2.057]
	Education	None	1	(ref)	1	(ref)	1	(ref)
		Primary	0.908	[0.707,1.165]	0.786	[0.522,1.183]	0.975	[0.587,1.619]
		Secondary or more	0.746	[0.542,1.028]	0.68	[0.357,1.292]	1.306	[0.627,2.722]
Literate	1.268	[0.989,1.626]	0.995	[0.692,1.431]	0.616*	[0.419,0.907]		
Occupational status	Homemaker	1	(ref)	1	(ref)	1	(ref)	
	Employed	0.709	[0.457,1.102]	0.921	[0.653,1.299]	0.786	[0.382,1.616]	
	Student, working without pay, other	0.781	[0.328,1.859]	0.889	[0.345,2.294]	0.775	[0.360,1.670]	
Household and community characteristics	Household expenditure quintile	1	1	(ref)	1	(ref)	1	(ref)
		2	0.971	[0.717,1.314]	0.919	[0.683,1.236]	0.652	[0.384,1.108]
		3	1.118	[0.849,1.473]	0.869	[0.612,1.233]	0.393***	[0.240,0.645]
		4	0.939	[0.720,1.223]	0.748	[0.540,1.036]	0.56	[0.312,1.006]
		5	1.033	[0.743,1.437]	0.824	[0.550,1.233]	0.358**	[0.193,0.667]
	Asset index	0.387	[0.143,1.046]	1.172	[0.372,3.690]	1.378	[0.294,6.456]	
	Household size	1.016	[0.953,1.083]	1.033	[0.973,1.096]	0.997	[0.955,1.040]	
	Urban ^b	0.771	[0.558,1.066]	0.559*	[0.339,0.921]			
	Female head of household	0.89	[0.619,1.279]	1.066	[0.769,1.479]	1.378	[0.929,2.043]	
	Indigenous household ^c	0.751	[0.541,1.044]	1.47	[0.873,2.475]			

*p-value<0.05 **p-value <0.01 ***p-value <0.001

^aMultivariable analysis is adjusted for all variables in column.

^bAll households in Panama were in rural areas, so this variable was not included in the stratified regression for this country.

^cAll households in El Salvador were non-indigenous, and all households in Panama were indigenous, so this variable was not included in the stratified regression for these countries. Very few households in Honduras were indigenous, so this variable was not included in the stratified regression for this country.

Table A13. Pooled analysis of individual, maternal, and household correlates of stunting, among children 6-59 months^a.

		Stunting (N=16,257)		
		OR	95% CI	
Country	El Salvador	1	(ref)	
	Guatemala	3.649***	[2.675,4.979]	
	Honduras	1.058	[0.805,1.390]	
	Mexico	1.379	[0.977,1.948]	
	Nicaragua	0.574***	[0.432,0.762]	
	Panama	1.971**	[1.304,2.981]	
Child characteristics	Female	0.863*	[0.769,0.969]	
	Age	6-11 months	1	(ref)
		12-23 months	2.299***	[1.795,2.944]
		24-35 months	3.723***	[2.915,4.756]
		36-47 months	4.127***	[3.203,5.317]
		48-59 months	3.954***	[3.130,4.994]
	Low birth weight	1.620***	[1.275,2.059]	
Exclusive breastfeeding for 6 months ^b	1.144*	[1.023,1.279]		
Sick in past 2 weeks	1.026	[0.917,1.149]		
Maternal characteristics	Age	15-19 years	1	(ref)
		20-34 years	0.710**	[0.557,0.904]
		35-49 years	0.497***	[0.370,0.667]
	Parity	1 child	1	(ref)
		2-3 children	1.305**	[1.112,1.532]
		4-5 children	1.714***	[1.409,2.085]
		6 or more children	1.918***	[1.515,2.430]
	Marital status	Married or in union	1	(ref)
		Single	1.082	[0.850,1.377]
		Divorced, separated, widowed, other	1.27	[0.955,1.689]
	Education	None	1	(ref)
		Primary	0.769**	[0.654,0.905]
		Secondary or more	0.594***	[0.468,0.755]
Literate	0.907	[0.783,1.051]		
Occupational status	Homemaker	1	(ref)	
	Employed	0.728	[0.516,1.027]	
	Student, working without pay, other	1.506	[0.905,2.505]	
Household and community characteristics	Household expenditure quintile	1	1	(ref)
		2	0.824*	[0.703,0.966]
		3	0.694***	[0.571,0.843]
		4	0.651***	[0.536,0.791]
		5	0.548***	[0.424,0.709]
	Asset index	0.230***	[0.119,0.443]	
	Household size	1.074***	[1.048,1.100]	
	Urban ^c	0.705**	[0.565,0.881]	
	Female head of household	1.154	[0.923,1.442]	
	Indigenous household ^d	1.915***	[1.492,2.457]	

*p-value<0.05 **p-value <0.01 ***p-value <0.001

^aMultivariable analysis is adjusted for all variables in column.

^bMother-reporting exclusive breastfeeding for the first six months of life or more.

^cAll households in Panama were in rural areas.

^dAll households in El Salvador were non-indigenous, and all households in Panama were indigenous.

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