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Determinants of Children's Nutritional Status in Malawi

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ABBREVIATIONS

HAZ	height-for-weight z-score
HDDS	Household Dietary Diversity Score
IHS	Integrated Household Survey
NSO	National Statistical Office of Malawi
OLS	Ordinary Least Squares
WAZ	weight-for-age z-score
WHZ	weight-for-height z-score

ABSTRACT

Malnutrition reduction efforts can be targeted based on the characteristics that affect children's nutritional status. Using data from a nationally representative survey, we model the determinants of young children's nutritional status in Malawi as measured by height-for-age and weight-for-height z-scores. We identify several determinants of children's nutritional status including their gender (boys are more malnourished than girls), their mother's education, the food security and location of their household (rural children are more acutely but not chronically malnourished than urban children) and access to clean water.

Key words: malnutrition, nutritional status, height-for age, weight-for-height, Malawi

1. INTRODUCTION

Despite some long-term global improvements in nutrition, the number of malnourished children has risen in recent years, especially in Africa as well as in West Asia and Latin America (Development Initiatives 2020). Malnutrition during gestation and early childhood has negative consequences lasting into adulthood: early-life malnutrition hinders later-life cognitive abilities (Berkman et al. 2002), educational attainment (Chang et al. 2002), health (Barker 1990) and lifetime earnings (Black, Devereux, Salvanes 2007; Bharadwaj, Lundborg, Rooth 2018). Where prevalent, these individual setbacks in aggregate hamper economic development at the national level (WHO 2017).

With high levels of child malnutrition, Malawi suffers gravely from its various consequences. Several studies have investigated the sources of malnutrition in the country, but the evidence is geographically limited (Sassi 2014) or based on old data (Maganga and Maganga 2018) and so far, inconclusive. Using the latest available nationally representative survey data to investigate the determinants of the nutritional status of under-five children in Malawi, the present paper fills this literature gap and is organized as follows: Section 2 outlines the conceptual framework of the study, section 3 describes the data and the methodology used to analyze it, section 4 presents and discusses the results and section 5 concludes.

2. CONCEPTUAL FRAMEWORK

A child's nutritional status is commonly measured using three anthropometric indices: weight-for-height, height-for-age, and weight-for-age. Weight-for-height compares a child's height to the typical weight of healthy children of the same height and sex. It is defined as a z-score (WHZ), calculated by subtracting from the child's weight a height- and sex-appropriate median value from a healthy population, and dividing the difference by the standard deviation of that population. It is a proxy for the child's nutritional status at the time of measurement, and its low values thus indicate acute malnutrition. A typical healthy child has WHZ of zero. A child whose WHZ is lower than -2 is considered wasted.

Similarly, height-for-age compares a child's height to the typical height of healthy children of the same age and sex. It is also defined as a z-score (HAZ) calculated using a standard population of an appropriate age and sex. It is a cumulative measure of a child's nutritional status, with low values indicating chronic malnutrition. A typical healthy child has HAZ of zero. A child whose HAZ is lower than -2 is considered stunted.

Weight-for-age compares a child's weight to the typical weight of healthy children of the same age and sex and is again defined as a z-score (WAZ) calculated using a standard healthy population. Being effectively a composite measure of weight-for-height and height-for-age, weight-for-age does not have a direct interpretation and is therefore not used in this paper.

Makombe *et al.* (2010) demonstrated that there is a strong association between household characteristics and food security and nutritional status. Gross *et al.* (2000) showed that there is a correlation between individual and household characteristics and food consumption. Strauss and Thomas (1998) provided evidence that there is also a relationship between an individual's nutritional status and environmental characteristics. Therefore, we propose a relationship between individual, household, environmental characteristics, and under-five child nutrition.

We expect individual child characteristics, especially gender, to affect nutritional outcomes. Although boys tend to be culturally preferred to girls, they have been shown to suffer from worse nutritional outcomes (Linnemayr, Alderman, Ka 2008).

Household characteristics are also expected to influence children's nutritional outcomes. Maganga and Maganga (2018) found that households in urban areas in Malawi were more likely to have malnourished children than those in rural areas, arguing that this is due to poor dietary quality rather than quantity. Other studies have shown that children living in rural areas are likely to have poor nutritional status due to high poverty levels (Kruger, Pretorius, Schutte 2010).

Based on the results of previous studies (Maganga and Maganga 2018; Betebo et al. 2017), we expect household size to have a negative effect on under-five nutrition, as land rather than labor tends to be the constraining factor of food production in Malawi.

Due to their inexperience in childcare, children of young mothers tend to be less well nourished than children of relatively older mothers (Linnemayr, Alderman, Ka 2008). Since it is not possible to determine the age of the children's mother from the IHS data, we instead hypothesize that the age of the household head is positively correlated with the age of the mother, and therefore with nutritional outcomes. For similar reason, we also expect children of educated mothers to have better nutritional outcomes than children of uneducated mothers.

Nutritional quantity and quality should naturally also affect nutritional outcomes. We expect children from food secure households to have higher WHZ and HAZ than children from food insecure households (Betebo et al. 2017; Wolfe and Frongillo 2001; Coates et al. 2006) and the number of daily meals typically eaten by children to positively affect their nutritional status. We further expect household per capita energy intake, animal protein intake and dietary diversity to be positively correlated with children's nutritional status (Mwaniki and Makokha 2013; Braun et al. 2016; Owolabi et al. 1996; Michalsen and Greer 2014; Hatløy, Torheim, Oshaug 1998; Ogle, Hung, Tuyet 2001; Torheim et al. 2003).

Good sanitation improves health by preventing the spread of infectious diseases, which would otherwise prevent individuals from fully processing the nutrients they consume (Maganga and Maganga 2018). We therefore expect access to a safe water source and a toilet to improve children's nutritional status. Similarly, we expect the utilization of health services such as under-five clinics and nutrition programs to improve children's nutritional status (Kansiime et al. 2017; Webb and Rogers 2003).

3. DATA AND METHODS

The study used the fourth Integrated Household Survey (IHS4) data collected in 2016–2017 by the National Statistics Office (NSO) in Malawi. The IHS4 is a multi-discipline survey, which collected data using household, agriculture, aquaculture, and community questionnaires. The household questionnaire collected data on household characteristics (socio-economic and demographic), child anthropometric measurements and safety net programs. It collected information from a sample of 12,447 rural households statistically planned to be representative at district and rural/urban levels after application of correct sampling weights. 5,244 of these households had one or more children under the age of five for whom weight-for-height or height-for-age could be calculated,[1] making for a total sample of 6,296 children (Table 1). Data from this sample was analyzed using STATA 16 and the zanthro (Vidmar, Cole, Pan 2016) and zscore06 (Leroy 2011) programs for anthropometric analysis.[2]

[1] Height/length is missing for 10 children from 6 families.

[2] *zanthro* can compute WHZ only for heights in excess of 65 cm, whereas *zscore06* can compute WHZ only for heights below 110 cm. On common support, they the WHZ score they produce are correlated at 0.9998. We use WHZ values produced by zanthro where possible and substitute them with values produced by zscore06 for children shorter than 65 cm. HAZ values produced by the two programs are identical.

Table 1. Children under five per household

Children under five per household	Households	Total children under five
1	4,258	4,258
2	926	1,852
3	56	168
4	2	8
5	2	10
Total	5,244	6,296

Note: Authors' calculations based on IHS4 data.

The two outcome variables used to measure children's nutritional status – a weight-for-height z-score (WHZ) for acute malnutrition and a height-for-age z-score (HAZ) for chronic malnutrition – are expressed as a number of standard deviation from a standard population mean (WHO 2006). With a mean of -0.102 and -1.137 respectively, the children in our sample are clearly less well-nourished than children in a standard population. With WHZ and HAZ lower than -2 indicating wasting (i.e. acute malnutrition) and stunting (i.e. chronic malnutrition) respectively, 6.8 percent of children in our sample are wasted and 28.9 percent are stunted (Table 2).

Table 2. Descriptive statistics (outcome variables)

Variable	Mean	Std. dev	Min	Max	Obs.[3]
Weight-for-height (WHZ)	-0.101	1.272	-4.986	4.958	6,278
Height-for-age (HAZ)	-1.147	1.147	-4.991	3.673	6,281
Wasted	0.068	0.251	0	1	6,278
Stunted	0.289	0.454	0	1	6,281

Note: Authors' calculations based on IHS4 data.

Table 3 presents a summary of the descriptive statistics of explanatory variables used in the study (see Table A 1 in the Annex for their precise definitions). The average child is 2 years and 9 months old and 51.3 percent are girls. 16.6 percent reside in urban areas in households with an average size of 5.2 members. 24.1 percent live in female-headed households, and the average household head age is 36.1 years. Only a minority of children's mothers finished primary education (22.8 percent).

77.2 percent of children live in food insecure households. However, most households still manage to consume a relatively calorie-rich and diverse diet with a median daily per capita energy consumption of 1,906 kcal and a median Household Dietary Diversity Score (HDDS) of 8, although most households did not consume any animal protein in the week prior to their interview. Children aged between 6 months and 5 years typically ate three meals a day while adults ate just two.

[3] Following common practice, we consider values more than 5 standard deviations from the standard population mean to be unrealistic (as a result of measurement and/or data entry errors). 7 observations had HWZ>5 and 6 observations had WHZ<-5. Additionally, 5 observations had weight and height values outside the WHO growth charts, preventing calculation of WHZ scores for them. Excluding these 18 observations reduces the sample size in estimations that include WHZ to 6,278. Separately, 15 observations had HAZ<-5, which reduces the sample size in estimations that include HAZ to 6,281. Including the observations with extreme WHZ and HAZ values in the estimations does not significantly alter the results (see model 2 in Table A 2 and model 2 in Table A 3 in the Annex).

87.3 percent of children in the sample lived in households with access to clean water and 90.9 percent had access to a toilet. 7.9 percent of children in the sample lived in households that participated in an under-five nutrition program in the year prior to the interview, and 75.2 percent of the children attended under-five clinics.

Table 3. Descriptive statistics (independent variables)

Variable	Mean	Std. dev.	Min.	Med.	Max.	Obs.
Child characteristics						
Female	0.513	0.500	0		1	6,296
Age (years)	2.730	1.283	0.083	2.750	4.917	6,296
Household characteristics						
Urban	0.166	0.372	0		1	6,296
Size	5.201	1.866	2	5	17	6,296
Female head	0.241	0.428	0		1	6,296
Head age (years)	36.081	11.341	16	34	94	6,296
Educated mother	0.228	0.419	0		1	6,296
Nutrition						
Low food security	0.772	0.419	0		1	6,295
Household dietary diversity score (HDDS)	7.832	2.304	3	8	12	6,296
Energy intake[4] ('000 kcal/person/day)	2.055	0.944	0.042	1.906	7.000	6,296
Protein intake (g/person/day)	3.624	6.640	0	0	99.283	6,296
Adult meals per day	2.420	0.589	0	2	4	6,296
Under-five meals per day[5]	2.701	0.877	0	3	9	5,973
Sanitation						
Clean water	0.873	0.333	0		1	6,296
Toilet	0.909	0.288	0		1	6,296
Use of health services						
Under-five nutrition program	0.079	0.269	0		1	6,296
Under-five clinic	0.752	0.432	0		1	6,296

Note: Authors' calculations based on IHS4 data.

[4] We consider daily per capita energy intake in excess of 7,000 kcal unrealistic (this being energy intake at the level of a top-flight sumo wrestler) and censor energy intake values at that value.

[5] The number of daily meals typically consumed by children aged between 6 months and 5 years is a problematic variable in IHS4: It is not reported for 284 households which have a child between 6 month and 5 years of age, but it is reported for 2,245 households without a child in that age range. We therefore consider this variable to be unreliable and do not include it in our main estimations, choosing to proxy for it by the number of meals consumed by adults in the household. Using the number of under-five meals with a reduced sample does not significantly alter the results (see model 3 in Table A 2 and model 3 in Table A 3 in the Annex).

We employ the ordinary least squares (OLS) method to determine and quantify the relationship between children's nutritional status and the explanatory variables described above by fitting the following model:

$$Y_i = \alpha + \boldsymbol{\beta}'\boldsymbol{X_i} + \varepsilon_i \qquad (1)$$

where Yi is the value of the outcome variable (WHZ or HAZ) of child i, X is a vector of explanatory variable and β a vector of their estimated coefficients. α is a constant term and ε a stochastic error term.

4. RESULTS AND DISCUSSION

Table 4 presents the OLS parameter estimates of the factors influencing children's weight-for-height z-score (WHZ) as a measure of acute malnutrition and height-for-weight z-score (HAZ) as a measure of chronic malnutrition.

Table 4. Main results

Dependent variable	(1) WHZ	(2) HAZ
Child characteristics		
Female	0.108^{***}	0.122^{***}
	(0.037)	(0.041)
Age	0.097^{***}	-0.254^{***}
	(0.016)	(0.017)
Household characteristics		
Urban	0.170^{***}	0.012
	(0.064)	(0.077)
Size	0.002	0.015
	(0.012)	(0.015)
Female head	0.042	0.020
	(0.054)	(0.058)
Head age	0.001	0.004^{*}
	(0.002)	(0.002)
Educated mother	0.080	0.196^{***}
	(0.053)	(0.054)
Nutrition		
Low food security	0.044	-0.202^{***}
	(0.057)	(0.062)
Household dietary diversity score (HDDS)	-0.004	-0.030^{**}
	(0.015)	(0.013)
Energy intake ('000 kcal/person/day)	0.030	0.003
	(0.024)	(0.032)

Dependent variable	(1) WHZ	(2) HAZ
Protein intake (g/person/day)	0.005	0.000
	(0.003)	(0.004)
Adult meals per day	0.052	0.020
	(0.049)	(0.040)
Sanitation		
Clean water	-0.006	0.172***
	(0.054)	(0.064)
Toilet	0.038	0.041
	(0.067)	(0.067)
Use of health services		
Under-five nutrition program	-0.197***	-0.103
	(0.074)	(0.076)
Under-five clinic	0.075	-0.212***
	(0.053)	(0.055)
Observations	6,277	6,280
R^2	0.021	0.065

Note: Authors' estimations based on IHS4 data. Standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

We find that girls have around 0.11 standard deviation higher WHZ and HAZ, i.e. are less acutely and chronically malnourished than boys, which is consistent with existing literature (Linnemayr, Alderman, Ka 2008). Older children are less likely to be acutely malnourished but more likely to be chronically malnourished.

Children in urban households are less acutely malnourished than children in rural households, but there is no meaningful difference between children in urban and rural households when it comes to chronic malnutrition. This suggests that the quality of nutrition in rural households is less stable than in urban households, but their average long-run nutritional quality is similar. Indeed, including the month of interview in the estimation (see model 4 in Table A 2 in the Annex) to account for seasonality reduces the magnitude of the effect of residence location on WHZ.

Interestingly, other household demographics such as household size and the sex and age of the household head make little meaningful difference to under-five nutritional status, both immediate and long-term. The level of education of the child's mother also does not impact acute malnutrition in a statistically significant way, but it has an effect on chronic malnutrition: Children whose mothers completed primary education have higher HAZ, i.e. they are less chronically malnourished, than children of uneducated mothers. The relationship between acute malnutrition and mother's education is, however, statistically insignificant. Assuming that educated mothers are better informed about health and nutrition issues, this suggest that they may not be able to prevent short term nutritional shortfalls but are better able to mitigate their cumulative effects on their children than uneducated mothers.

Similarly, household food security status has a large and significant effect on chronic malnutrition but not on acute malnutrition, even though its measure is based on a one-week recall period.

Chronic malnutrition is also affected by dietary diversity as measured by the HDDS, but curiously, dietary diversity is negatively correlated with HAZ, i.e. chronically malnourished children live in households with higher dietary diversity. However, this may be a reaction to their malnutrition rather than its cause as parents attempt to improve their diet, or a secondary effect of food insecurity as households diversify their consumption to include less preferred foods such as fruit in place of maize (Gelli et al. 2020).

Household per capita energy intake, per capita animal protein intake and the number of meals typically consumed by adult household members do not affect under-five nutritional status at all. Because individual energy and protein intake should have a strong impact on both immediate and cumulative nutritional status, the lack of detectable impact of their average per capita measures suggests that the way available food is distributed to individuals within a household differs across households.

Access to a clean water source also improves children's long-term nutritional outcomes as measured by HAZ but not immediate outcomes measured by WHZ. Access to a toilet seems to have no effect on children's nutritional status.

Children living in households who participate in under-five nutrition programs have lower WHZ than other children, and children who attend an under-five clinic have lower HAZ than other children. These relationships are contrary to the influence that such programs should have on children's nutrition, which suggests that the services are used in reaction to children's poor nutritional status, not that such programs have a negative impact on it.

Overall, the estimated relationship between the outcome variables and their determinants is robust to re-specifying the models as linear probability of binary variables indicating wasting and stunting (see model 5 in Table A 2 and model 4 in Table A 3 in the Annex). However, it is evident from the low R^2 values on all estimated models that the nutrition determinants investigated here explain only a small part in the variation of the nutritional status of under-five children.

5. CONCLUSION

We model the factors associating with the nutritional status of under-five children in Malawi by conducting an empirical analysis using IHS4 data, with weight-for-height and height-for-age z-scores (WHZ and HAZ) standing in for acute and chronic nutritional status and a number of socio-economic and environmental factors as potential determinants of these outcomes.

We find that girls have on average better nutritional status than boys, both in the short term (WHZ) and in the long term (HAZ). Children in urban households suffer from less acute malnutrition than their rural counterparts, but this positive effect does not translate into lower levels of chronic malnutrition. Mother's education, access to clean water and food security positively affect children's height-for-age but not their weight-for-height.

These relationships are robust, but only explain a small part of the variation in children's nutritional status. A dedicated dataset with a wider range of potential determinants would be needed to investigate the sources of under-five malnutrition in Malawi further.

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ANNEX

Table A 1. Independent variables

Variable	Definition
Child characteristics	
Female	1 if female; 0 otherwise
Age	Age in years
Household characteristics	
Urban	1 if residing in an urban area; 0 otherwise
Size	Number of people who normally live and eat their meals together in the household
Female head	1 if household head is female; 0 otherwise
Head age	Age of household head in years
Educated mother	1 if child's mother obtained primary school leaving certificate; 0 otherwise
Nutrition	
Low food security	1 if the household had to resort to any of the following in the week prior to the interview: rely on less preferred and/or less expensive foods, limit portion size at meal-times, reduce number of meals eaten in a day, restrict consumption by adults in order for small children to eat, borrow food, or rely on help from a friend or relative; 0 otherwise
Household dietary diversity score (HDDS)	Number of food groups consumed in household in the week prior to the interview. The food groups are (1) cereals, (2) roots and tubers, (3) vegetables, (4) fruits, (5) meat, poultry and offal, (6) effs, (7) fish and seafood, (8) pulses, legumes and nuts, (9) milk and dairy products, (10) oil and fats, (11) sugar and honey, (12) miscellaneous (condiments, coffee, tea, etc.).
Energy intake	Daily per capita energy intake in thousands of kilocalories calculated from a weekly recall of foodstuffs consumed by the household.
Protein intake	Daily per capita animal protein intake in grams calculated from a weekly recall of foodstuffs consumed by the household
Adult meals per day	Number of meals typically consumed in a day by adult members of the household
Under five meals per day	Number of meals typically consumed in a day by children in the household aged between 6 months and 5 years
Sanitation	
Clean water	1 if the household has accesses drinking water from an improved source (piped water, protected well, borehole, tanker truck or bowser, bottled water); 0 otherwise
Toilet	1 if household has a toilet; 0 otherwise
Use of health services	
Under-five nutrition program	1 if household took part in an under-five nutrition program in the year prior to the interview; 0 otherwise
Under-five clinic	1 if the child participates in an under-five clinic; 0 otherwise

Source: Authors' compilation.

Table A 2. Robustness checks (weight-for-height)

Dependent variable	(1) WHZ	(2) WHZe	(3) WHZ	(4) WHZ	(5) Not wasted
Child characteristics					
Female	0.108***	0.111***	0.108***	0.112***	0.020**
	(0.037)	(0.037)	(0.037)	(0.037)	(0.008)
Age	0.097***	0.099***	0.101***	0.097***	0.015***
	(0.016)	(0.016)	(0.016)	(0.016)	(0.004)
Household characteristics					
Urban	0.170***	0.161**	0.166**	0.143**	0.013
	(0.064)	(0.065)	(0.067)	(0.066)	(0.012)
Size	0.002	-0.001	0.004	0.001	0.000
	(0.012)	(0.012)	(0.012)	(0.012)	(0.002)
Female head	0.042	0.043	0.038	0.038	0.008
	(0.054)	(0.055)	(0.056)	(0.054)	(0.010)
Head age	0.001	0.002	0.001	0.001	-0.000
	(0.002)	(0.002)	(0.002)	(0.002)	(0.000)
Educated mother	0.080	0.073	0.078	0.081	0.005
	(0.053)	(0.053)	(0.055)	(0.053)	(0.010)
Nutrition					
Low food security	0.044	0.053	0.054	0.038	0.011
	(0.057)	(0.058)	(0.057)	(0.056)	(0.011)
Household dietary diversity score (HDDS)	-0.004	0.001	-0.001	-0.007	0.005*
	(0.015)	(0.015)	(0.015)	(0.015)	(0.003)
Energy intake (‘000 kcal/person/day)	0.030	0.031	0.034	0.030	-0.004
	(0.024)	(0.024)	(0.024)	(0.024)	(0.005)
Protein intake (g/person/day)	0.005	0.005	0.005*	0.005	0.001
	(0.003)	(0.003)	(0.003)	(0.003)	(0.001)
Adult meals per day	0.052	0.050	0.080	0.056	0.001
	(0.049)	(0.050)	(0.049)	(0.049)	(0.010)
Under five meals per day			-0.044		
			(0.029)		
Sanitation					
Clean water	-0.006	-0.009	-0.022	0.000	-0.007
	(0.054)	(0.056)	(0.055)	(0.054)	(0.011)
Toilet	0.038	0.059	0.048	0.052	0.003

	(0.067)	(0.068)	(0.068)	(0.066)	(0.014)
Use of health services					
Under-five nutrition program	-0.197***	-0.201***	-0.211***	-0.192***	-0.033**
	(0.074)	(0.075)	(0.076)	(0.072)	(0.016)
Under-five clinic	0.075	0.065	0.079	0.073	-0.001
	(0.053)	(0.056)	(0.054)	(0.052)	(0.010)
Month of interview fixed effects	NO	NO	NO	YES	NO
N	6,277	6,290	5,957	6,277	6,277
R^2	0.021	0.021	0.023	0.025	0.013

Note: Authors' estimations based on IHS4 data. Model 1 corresponds to model 1 in Table 4 for ease of comparison with the remaining models in this table. WHZe is identical to WHZ but includes extreme values (<-5 and >5). Not wasted is the inverse of the wasted dummy to make the interpretation of +/- signs consistent with WHZ models in this table. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A 3. Robustness checks (height-for-age)

Dependent variable	(1) HAZ	(2) HAZe	(3) HAZ	(4) Not stunted
Child characteristics				
Female	0.122***	0.135***	0.112***	0.041***
	(0.041)	(0.042)	(0.042)	(0.014)
Age	-0.254***	-0.253***	-0.253***	-0.047***
	(0.017)	(0.018)	(0.017)	(0.005)
Household characteristics				
Urban	0.012	0.029	-0.009	-0.007
	(0.077)	(0.077)	(0.077)	(0.021)
Size	0.015	0.012	0.017	0.003
	(0.015)	(0.016)	(0.016)	(0.005)
Female head	0.020	0.010	0.018	0.010
	(0.058)	(0.061)	(0.059)	(0.018)
Head age	0.004*	0.004*	0.004*	0.001
	(0.002)	(0.002)	(0.002)	(0.001)
Educated mother	0.196***	0.191***	0.192***	0.061***
	(0.054)	(0.056)	(0.055)	(0.018)
Nutrition				
Low food security	-0.202***	-0.213***	-0.208***	-0.045**
	(0.062)	(0.063)	(0.063)	(0.018)
Household dietary diversity score (HDDS)	-0.030**	-0.033**	-0.032**	-0.007*
	(0.013)	(0.013)	(0.014)	(0.004)
Energy intake (‘000 kcal/person/day)	0.003	0.011	0.012	0.002
	(0.032)	(0.032)	(0.033)	(0.010)
Protein intake (g/person/day)	0.000	0.001	-0.000	0.001
	(0.004)	(0.004)	(0.004)	(0.001)
Adult meals per day	0.020	0.014	0.017	-0.003
	(0.040)	(0.041)	(0.045)	(0.014)
Under five meals per day			-0.004	
			(0.031)	
Sanitation				
Clean water	0.172***	0.152**	0.178***	0.063***
	(0.064)	(0.064)	(0.065)	(0.021)
Toilet	0.041	0.049	0.045	0.002

	(0.067)	**(0.067)**	**(0.070)**	**(0.024)**
Use of health services				
Under-five nutrition program	-0.103	-0.129	-0.121	-0.018
	(0.076)	(0.079)	(0.077)	(0.025)
Under-five clinic	-0.212***	-0.220***	-0.210***	-0.047**
	(0.055)	(0.056)	(0.058)	(0.019)
N	6,280	6,295	5,957	6,280
R^2	0.065	0.059	0.065	0.024

Note: Authors' estimations based on IHS4 data. Model 1 corresponds to model 2 in Table 4 for ease of comparison with the remaining models in this table. HAZe is identical to HAZ but includes extreme values (<-5 and >5). Not stunted is the inverse of the wasted dummy to make the interpretation of +/- signs consistent with HAZ models in this table. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

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