Individual-, Household-, and Community-Level Determinants of Childhood Undernutrition in Bangladesh

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Abstract

Introduction: Childhood undernutrition is a crucial public health problem globally. The objective of this study is to measure the prevalence of childhood undernutrition and assess the distinct role of various factors on childhood undernutrition in Bangladesh.

Methods: This study utilized the latest cross-sectional data from Bangladesh Demographic and Health Survey 2014. A total of 7256 data on children younger than 5 years old were analyzed. The undernutrition status of children was assessed by stunting (height-for-age), wasting (weight-for-height), and underweight (weight-for-age), while bivariate and multivariate analyses were performed to identify various individual-, household-, and community-level factors of childhood undernutrition.

Results: The prevalence of stunting, wasting, and underweight were 36.5%, 14.6%, and 32.5%, respectively. Along with various individual- and household-level factors (eg, age, recent diarrheal disease, fever, number of under-5 children in the household, mother's education and nutritional status, and wealth status), community index, particularly regional and geographic variation of community, had significant role for childhood undernutrition in Bangladesh.

Conclusion: Childhood undernutrition is an overwhelming public health issue in Bangladesh. In order to improve the nutritional status of under-5 children, interventions should take into account the various predictors discussed in this study. Indeed, a joint effort by the government, nongovernmental organizations, and the community is necessary to improve the childhood nutritional status in Bangladesh.

Keywords
child health, community, determinants, undernutrition, Bangladesh

Introduction

Childhood undernutrition is still a crucial public health problem and an emerging policy issue globally, particularly in resource-poor countries.[1] Childhood undernutrition is directly linked to cognitive development and childhood physical growth and appeared as one of the strongest single risk factors for early neonatal mortality and morbidity.[2] It is well documented that malnourished children often have various infections including diarrhea, pneumonia, and malaria, and about 45% of deaths of children younger than 5 years are due to nutrition-related factors.[3] Although undernutrition is a multifaceted indicator, stunting (low height-for-age), wasting (low weight-for-height), and underweight (low weight-for-age) are widely used as indicators of undernutrition.[4,5]

Although the prevalence of childhood stunting is on a downward trend, still about 155 million under-5 children have stunting globally, and most of them are living in low-income countries in Asia and Africa.[6] The number of children with severe and moderate stunting was found as the highest in the South Asian region, including Bangladesh. In line with stunting, wasting is also a public health threat in Southern Asia, which contains half of children with wasting.[7,8] Underweight is another burning child health issue. It was found that

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approximately 16% of the under-5 children were underweight globally in 2011.[5] Like stunting and wasting, the prevalence of underweight children is high in the South Asian region.[5] Recent data showed that Bangladesh has experienced significant progress in improving childhood undernutrition. While the level of stunting has dropped substantially from 51% in 2004 to 36% in 2014, the declining rate of wasting and underweight was not satisfactory and is even inadequate.[5] Wasting declined by 1% from 2004 to 2014, while the prevalence of underweight children reduced by 10% in Bangladesh.[9]

Childhood undernutrition is a complex phenomenon that is directly influenced by various factors of individual, household, and community levels.[5] The United Nations Children's Fund has documented 3 common causes of undernutrition. These are (1) immediate causes that include inadequate dietary intake and disease infections such as pneumonia, malaria, diarrhea, and measles; (b) underlying causes, including insufficient access to food, insufficient health-care services, unhealthy environment, and inadequate care; and (c) basic causes encompassing insufficient current and potential resources at the societal level.[4]

Although the abovementioned framework has clearly indicated the importance of societal factors, most of the study focused on the association between the undernutrition and the individual-level factors rather than holistic approaches.[1,10-15] A body of literature highlighted the association between childhood undernutrition and various factors such as socioeconomic factors of individual,[5,16-18] demographic characteristics,[5,11,17,18] environmental factors,[5] household factors,[4,5,11,12,14,17,19] parental characteristics,[5,10,12,15,17,20] child-feeding practices,[19] geographical location, and place of residence.[11,21,22] The community-level factors are found to be an important element for tackling childhood undernutrition, particularly for developing countries.[4,17,23] Various studies showed that community-level factors have influences on individual health outcomes after controlling the individual-level socioeconomic factors.[4,23,24] The underlining principle of community-level effects on individual nutritional status implies that 2 otherwise identical children may have dissimilar nutritional status only for the reason of type of community.[4] Yet, such hypotheses have not been widely inspected in many developing countries such as Bangladesh. In addition, community factors encompass a plethora of elements, most of which alone may not contribute much but their combined effects are expected to be larger. This issue leaves an implementation challenge for the researcher. To address this knowledge gap, the objective of this study is to assess the impact of both individual- and community-level factors on childhood undernutrition in Bangladesh with a view to informing policy development.

Methods

Data

This study used data from the latest Bangladesh Demographic and Health Survey (BDHS) 2014, which is a nationally representative cross-sectional household survey executed by the National Institute of Population Research and Training of the Ministry of Health and Family Welfare. The detailed method, sampling technique, survey design, instruments, measuring system, data validity, reliability, and quality control are described elsewhere.[9] Data were collected from June 28, 2014, to November 9, 2014. A total of 17 863 ever-married women aged 15 to 49 years were interviewed with a 98% response rate. This data set includes information on child health, reproductive health, and nutritional status. The BDHS data set is available publicly online for researchers; yet, to use these data, approval was required from and given by MEASURE DHS (Measure Demographic and Health Survey) program office. Although the BDHS-2014 data set contains a total of 8325 under-5 children, this study focuses on children for who complete data on nutritional status were available, resulting in a total of 7256 children.

Outcome Variables

The widely used indicators for measuring the nutritional status of children are height-for-age, weight-for-height, and weight-for-age. In terms of height-for-age, a child is classified as stunted if she or he is more than 2 standard deviations below the median ($-2SD$) of the World Health Organization reference population.[5,22] If a child is more than 2 standard deviations below ($+2SD$) the reference median for weight-for-height, she or he is considered as wasted. A child is categorized as underweight if his or her weight-for-age is lower than 2 standard deviations ($-2SD$) from the median of the reference population.

Explanatory Variables

Explanatory variables in this study were categorized into 3 levels: individual level, household/maternal level, and community level.[4,5]

Individual-Level Factors

Individual-level factors are sex of the child (eg, male or female), age of the child in month (eg, <6, 6-12, 13-23, 23-35, 36-47, and 48-59 months), size of the child at birth (eg, smaller than average, average, and larger than average), morbidity status (eg, presence of fever, diarrhea, and acute respiratory infection [ARI] 2 weeks prior to the survey or not), type of birth (eg, multiple or single), and birth order (eg, 1, 2-3, 4-5, 6, and above). Per BDHS 2014, mothers were asked about their perception of their child's size at birth: average or larger, small, or very small. The study used this perceived birth size as a proxy for birth weight since most of the deliveries in Bangladesh took place at home where newborns are not weighed at birth.

Maternal-/Household-Level Factors

Maternal-level factors are mother's education level (eg, no formal education, primary education, secondary education, and higher education) and the body mass index (BMI; eg, <18.5

kg/m^2 = thin, 18.5e24.9 kg/m^2 = normal, and ≥25 kg/m^2 = overweight). Household-level factors are household size (categorized as 1-4, 5-6, and above 6), number of children less than 5 years old, and wealth index (poorest, poor, middle, rich, and richest).

Community-Level Factors

As earlier studies, community-level factors are formed by aggregating individual- and maternal-level data to the cluster level.[4,24] Communities were defined based on sharing a common primary sample unit as described in BDHS 2014 data set. The community-level variables are community wealth, community-level mother's education, community fertility rate, community antenatal care, community skilled delivery, availability of health facilities in the community, availability of mother's club in the community, nongovernmental organization (NGO) membership in community, and location of residence. Community wealth status was defined as the proportion of households in the community in the upper 40% wealth quintile (categorized as <25% = low, 25%-50% = moderate, and >50% = high wealth status communities).[24] Community-level maternal education was defined as the percentage of mothers aged 15 to 49 years in the community with secondary or higher education (categorized as <25% = low, 25%-50% = moderate, and >50% = high education communities); community skilled delivery was defined as the percentage of mothers aged 15 to 49 years in the community whose delivery was attended by skilled birth attendants like physician, obstetrician, midwife, nurse, or other health-care professional (categorized as use of skilled birth attendants <25% = low, 25%-50% =medium, above 50% = high); community prenatal care use was defined as the percentage of mothers aged 15 to 49 years in the community who had received prenatal care services from a doctor, clinical officer, medical assistant, nurse, or midwife (categorized as use of prenatal care <25% = low, 25%-50% = medium, above 50% = high); and community fertility was defined as aggregate values of community level of fertility derived from data on children ever born (categorized as "<2.3 = low" and ">2.3 = high fertility communities"), taking the mean value to fertility at national level. Availability of mother's club was categorized as "available" and "not available"; availability of NGO membership was defined as "available" and "not available." Location of residence was categorized as "rural" and "urban," while the geographic location of the household was categorized according to 7 administrative divisions of Bangladesh. As community factors are likely to be highly correlated, we constructed an index of community status with all the community-level variables using the principal component analysis (PCA). When the independent variables have multicollinearity, the coefficients of each variable may be insignificant individually, though can be significant overall. A principal component analysis can overcome this problem.[25]

Statistical Analysis

Before the analysis, all influential/outlier and missing observations were determined and excluded from the data set. Descriptive analysis such as frequency distribution as well as cross-tabulation was applied for measuring the prevalence of stunting, wasting, and underweight concerning important variables. Bivariate analysis was considered to measure the association between dependent and independent variables using cross tables as well as χ^2 tests. In the bivariate analysis, those factors having P values <.25 were chosen as the variables in the logistic regression models.[5] Since the dependent variables (stunting, wasting, underweight) are dichotomized, we used 3 different multivariate logistic regression models to estimate the effect of individual-, household-, and community-level variables on stunting (model I), wasting (model II), and underweight (model III). Results have been stated as adjusted odds ratios (AOR) with 95% confidence intervals (CIs). Statistical significance of different factors has been decided considering the P values. All statistical analyses were carried out using the statistical package Stata/SE 14 software.

Results

Background Characteristics and Undernutrition

Prevalence of stunting. Table 1 shows that 36.45% of children less than 5 years old are stunted. The prevalence of stunting is high among children aged 18 to 23 months (43.63%), followed by those aged 48 to 59 months (38.10%). The prevalence of stunting is slightly higher among the male children (37.33%) than female children (35.53%). The prevalence of stunting is higher among children who had fever, diarrhea, or ARIs than their counterpart. Stunting rate is higher among children who have multiple births (have twins) compared to those with a single birth (50.00% vs 36.41%). The prevalence of stunting is the highest (50.27%) among children whose mothers have no education. The rate of stunted children is larger among children of underweight mothers (46.34%) and poorest wealth quintile (50.89%). Urban children are less stunted than rural children (32.15% vs 38.40%). The highest percentage of stunted children is found in Sylhet division (49.08%). Regarding the community-level factors, the proportion of children with stunting is higher among children from poor communities (42.48%) compared to rich communities (28.86%). The prevalence rate of childhood stunting is found to be the highest (53.82%) from communities with a low level of mother's education. About 58% and 44% of children are stunted from communities with a low percentage of prenatal care and low rate of skilled delivery care, respectively. The prevalence of stunting is high (38.24%) in communities with a high fertility rate and found higher where mothers club (37.20%) and NGOs membership (42.50%) were not available.

Prevalence of wasting. The prevalence of wasting is the highest among children aged below 6 months (19.29%). Male children (15.33%) are more prone to wasting than female children

(13.76%). Children who were born with a birth size less than average are more wasted (21.77%) compared to those had a larger size (9.24%). The prevalence of wasting increases with birth order and for low-weight mothers (18.24%). The prevalence of children with wasting is highest in the poorest families (17.84%) and whose mother completed only primary education (16.54%) instead of higher education (11.96%). The prevalence of children with wasting is also highest in communities with low wealth status (16.30%), low maternal education (15.06%), low use of antenatal care (17.88%), high fertility rate (14.82%), no NGO's membership (14.57%), no mother's club (14.74%), and communities located in the rural area (15.73%). The prevalence of wasting in children is the highest in Barisal division (17.41%).

Prevalence of underweight. The study indicated that about 33% of children less than 5 years old are underweight. The prevalence of underweight is high among children aged 48 to 59 months (38.44%) and who lived in rural areas (35%). Children of mothers with no education are more likely to be underweight (50.28%) compared to children of mothers with primary, secondary, and higher education. The prevalence of underweight children is high in the poorest wealth quintiles (40.20%) than the richest wealth quintiles (17.94%). The proportion of underweight children is high among children who had a small size at birth, multiple birth, who do not have access to safe drinking water, and who had fever, diarrheal disease, and respiratory infection (Table 1). Regarding community-level factors, the prevalence of underweight children is the highest in the rural communities (34.94%) and who lived in Sylhet division (39.79%). The prevalence is high in communities with low wealth status (38.92%), low maternal education (45.62%), low maternal care utilization (52.51%), high fertility rate (33.82%), and communities where no mothers' club is observed (33.05).

Factors of undernutrition. The study observed that sex of a child, age, type of birth, birth order, fever, diarrhea, ARI in the previous 2 weeks preceding the survey, mother's education, mother's BMI, number of less than 5 years old children, access to safe drinking water, wealth status, and all community-level factors were significantly associated with childhood undernutrition (Table 1). In the multivariate analysis, considering the individual-level factors, age, fever, and/ or diarrhea in the last 2 weeks preceding the survey were found as significant predictors for childhood undernutrition (Table 2). As age increases, the odds of being stunted increases significantly. Children who are twins are more likely to be stunted compared to those who had single birth (AOR = 1.65, $P <$ .10 level). The odds of being stunted was 1.19 times higher among children who had fever and 1.37% higher for children who had diarrheal infections, and both the results were significant ($P <$ .05) level.

Among the maternal- and household-level factors, mother's education, BMI status of the mother, number of under-5 children in the household, and wealth status were found to have a significant influence on childhood undernutrition. Mother's education is a crucial factor for tackling childhood stunting, as we observed that childhood stunting is common for low or uneducated mothers. For instances, our study observed that children of mothers with no education are 72% more likely to have stunting compared to children of mothers with higher education. Similarly, the mother's BMI status has a significant role in childhood stunting (AOR = 1.68, CI, 1.36-2.32, $P <$ .01). Children from the poorest wealth quintiles have significantly higher odds (AOR = 3.18, $P <$ .01) of being stunted compared to the wealthiest quintile. Again, the number of children less than 5 years old in the household is also a significant predictor of stunting. Region of residence has a significant impact on nutritional status; urban children are more likely to be stunted compared to the rural areas (AOR = 1.32, $P <$ .01). Children who are from Barisal, Chittagong, Dhaka, and Sylhet division have significantly higher odds of being stunted compared to those from Rajshahi division.

Regarding childhood wasting, the age of the children is a proven significant factor (Table 2). Considering maternal- and household-level factors, child of an underweight mother has a higher likelihood of being wasted (AOR = 1.77, $P <$ .01). Children from the lowest wealth quintiles have a higher likelihood of being wasted compared to the richest households ($P <$ .10). Regarding administrative divisions, children from Khulna (AOR = 0.72, $P <$ .05) and Sylhet (AOR = 0.55, $P <$ .05) have less likelihood of being wasted compared to children from Rajshahi division. No other community-level factors were found as significant predictors of childhood wasting.

Like wasting, the likelihood of being underweight increases with the age of the child (Table 2). Children who had multiple birth have a higher likelihood of being underweight compared to single birth (AOR = 1.63, $P <$ .10 level). Similarly, children who had fever within the last 2 weeks have significantly higher odds (AOR = 1.29, $P <$ .01). Mother's education is a significant predictor of child nutritional status, as the likelihood of being underweight increases for children of mothers with no, primary, and secondary education compared to higher education status. Children from the poorest (AOR = 2.36, $P <$ .01), poor (AOR = 1.97, $P <$ .01), and middle-income (AOR = 1.82, $P <$ .01) quintiles are more likely to be underweight compared to the richest income quintile. Children from Chittagong division have significantly 31% more likelihood of being underweight (AOR = 1.31, $P <$ .05) compared to children from Rajshahi division. Other community-level factors were found as insignificant predictors in this study. The result from the PCA showed that controlling for other variables (sex, age of children, type of birth, birth order, fever in the last weeks, recent diarrheal disease, ARI, mother's education level, mother's BMI, number of under-5 children in the household, access to safe drinking water, family wealth quintile), a better community status significantly decreases the likelihood of being stunted (AOR = 0.89, $P <$ .01). In cases of wasting and underweight, similar signs are observed though they are insignificant (Table 3).

Table 1. Prevalence of Childhood Undernutrition in Bangladesh.

Variable	Total Sample, n (%)	Stunted, n (%)	Wasted, n (%)	Underweight, n (%)
Outcome variables				
Childhood undernutrition	7256 (100)	2645 (36.45)	1057 (14.57)	2359 (32.51)
Individual-level factors				
Sex of the child				
Female	3532 (48.68)	1255 (35.53)	486 (13.76)	1157 (32.76)
Male	3724 (52.32)	1390 (37.33)	571 (15.33)	1202 (32.28)
		P = 0.11	P = 0.06	P = 0.66
Age of child				
<6	565 (7.79)	66 (11.68)	109 (19.29)	94 (16.64)
6-8	395 (5.44)	62 (15.70)	54 (13.67)	56 (14.18)
9-11	405 (5.58)	103 (25.43)	75 (18.52)	105 (25.93)
12-17	786 (10.83)	266 (33.84)	141 (17.94)	243 (30.92)
18-23	706 (9.73)	308 (43.63)	98 (13.88)	225 (31.87)
24-35	1469 (20.25)	620 (42.21)	181 (12.32)	536 (36.49)
36-47	1463 (20.16)	661 (45.18)	180 (12.30)	536 (36.64)
48-59	1467 (20.22)	559 (38.10)	219 (14.93)	564 (38.45)
		P = 0.001	P = 0.001	P = 0.001
Size of the child at birth				
Smaller than average	804 (19.12)	366 (45.52)	175 (21.77)	367 (45.65)
Average	2849 (67.75)	896 (31.45)	414 (14.53)	766 (26.89)
Larger than average	552 (13.13)	128 (23.19)	51 (9.24)	92 (16.67)
		P = 0.001	P = 0.001	P = 0.001
Birth order				
1	2700 (38.76)	884 (32.74)	391 (14.48)	810 (30.00)
2-3	3196 (45.88)	1152 (36.05)	455 (14.24)	022 (31.98)
4-5	803 (11.53)	355 (44.21)	115 (14.32)	311 (38.73)
6 and above	267 (3.83)	156 (58.43)	45 (16.85)	118 (44.19)
		P = 0.001	P = 0.71	P = 0.001
Fever in the last weeks				
No	4389 (63.08)	1528 (34.81)	575 (13.10)	1325 (30.19)
Yes	2569 (36.92)	1017 (39.59)	426 (16.58)	932 (36.28)
		P = 0.001	P = 0.001	P = 0.001
Recent diarrheal disease				
No	6622 (95.16)	2391 (36.11)	940 (14.20)	2125 (32.09)
Yes	337 (4.84)	154 (45.70)	61 (18.10)	132 (39.17)
		P = 0.001	P = 0.04	P = 0.01
Acute respiratory infection				
No	4669 (67.09)	1671 (35.79)	641 (13.73)	1464 (31.36)
Yes	2290 (32.91)	874 (38.17)	360 (15.72)1	793 (34.63)
		P = 0.05	P = 0.03	P = 0.01
Type of birth				
Single birth	6885 (98.85)	2507 (36.41)	994 (14.44)	2224 (32.30)
Multiple birth	80 (1.15)	40 (50.00)	11 (13.75)	36 (45.001)
		P = 0.01	P = 0.86	P = 0.02
Maternal/HH-level factors				
Mother's education level				
No education	1076 (15.45)	541 (50.28)	162 (15.06)	468 (43.49)
Primary	1935 (27.78)	865 (44.70)	320 (16.54)	769 (39.74)
Secondary	3219 (46.21)	998 (31)	436 (13.54)	896 (27.83)
Higher	736 (10.57)	143 (19.43)	88 (11.96)	128 (27.39)
		P = 0.001	P = 0.01	P = 0.001
Mothers's BMI				
Underweight	943 (16.37)	437 (46.34)	172 (18.24)	436 (46.24)
Normal	3529 (61.28)	1327 (37.60)	491 (13.91)	1118 (31.68)
Overweight	1287 (22.35)	320 (24.86)	131 (10.18)	265 (20.59)
		P = 0.001	P = 0.001	P = 0.001
Number of under-5 children in the HH				
1	4927 (67.90)	1710 (34.71)	734 (14.90)	1549 (31.44)

Table 1. (continued)

Variable	Total Sample, n (%)	Stunted, n (%)	Wasted, n (%)	Underweight, n (%)
2	1911 (26.34)	770 (40.29)	258 (13.50)	672 (35.16)
3	418 (5.76)	165 (39.47)	65 (15.55)	138 (33.01)
		P = 0.001	P = 0.29	P = 0.01
HH size				
1-4	2306 (31.78)	830 (35.99)	332 (14.40)	745 (32.31)
5-6	2602 (35.86)	956 (36.74)	387 (14.87)	851 (32.71)
Above 6	2348 (32.36)	859 (36.58)	338 (14.40)	763 (32.50)
		P = 0.85	P = 0.85	P = 0.95
Access to safe drinking water				
No	160 (2.21)	69 (43.13)	33 (20.63)	63 (39.38)
Yes	7096 (97.79)	2576 (36.30)	1024 (14.43)	2296 (32.36)
		P = 0.08	P = 0.03	P = 0.06
Wealth quintile				
Poorest	1580 (21.78)	804 (50.89)	282 (17.85)	730 (46.20)
Poor	1370 (18.88)1	556 (40.58)	238 (17.37)	522 (38.10)
Middle	1445 (19.91)	540 (37.37)	213 (14.74)	475 (32.87)
Richer	1479 (20.38)1	465 (31.44)	178 (12.04)	384 (25.96)
Richest	1382 (19.05)	280 (20.26)	146 (10.56)	248 (17.95)
		P = 0.001	P = 0.001	P = 0.001
Community-level factors				
Place of residence				
Rural	4989 (68.76)	1916 (38.40)	785 (15.73)	1743 (34.94)
Urban	2267 (31.24)	729 (32.16)	272 (12.00)	616 (27.17)
		P = 0.001	P = 0.001	P = 0.001
Division				
Barisal	850 (11.71)	320 (37.65)	148 (17.41)	286 (33.65)
Chittagong	1360 (18.74)	517 (38.01)	200 (14.71)	464 (34.12)
Dhaka	1257 (17.32)	417 (33.17)	153 (12.17)	348 (27.68)
Khulna	804 (11.08)	231 (28.73)	108 (13.43)	213 (26.49)
Rajshahi	924 (12.73)	281 (30.41)	160 (17.32)	292 (31.60)
Rangpur	910 (12.54)	314 (34.51)	148 (16.26)	298 (32.75)
Sylhet	1151 (15.86)	565 (49.09)	140 (12.16)	458 (39.79)
		P = 0.001	P = 0.001	P = 0.001
Community wealth				
Low	3117 (42.96)	1324 (42.48)	508 (16.30)	1213 (38.92)
Middle	1814 (25)	650 (35.83)	82 (15.55)	578 (31.86)
High	2325 (32.04)	671 (28.86)	267 (11.48)	568 (24.43)
		P = 0.001	P = 0.001	P = 0.001
Community mother's education				
Low	890 (12.27)	479 (53.82)	134 (15.06)	406 (45.62)
Middle	2116 (29.16)	852 (40.26)	328 (15.50)	791 (35.49)
High	4257 (58.57)	1314 (30.92)	595 (14.00)	1202 (28.28)
		P = 0.001	P = 0.25	P = 0.001
Community prenatal care				
Low	179 (2.47)	103 (57.54)	32 (17.88)	94 (52.51)
Middle	812 (11.19)	368 (45.32)	140 (17.24)	346 (42.61)
High	6265 (86.34)	2174 (34.70)	885 (14.13)	1919 (30.63)
		P = 0.001	P = 0.03	P = 0.001
Community skilled delivery				
Low	2601 (35.85)	1152 (44.29)	410 (15.76)	1019 (39.18)
Middle	2404 (33.13)	870 (36.19)	355 (14.77)	778 (32.36)
High	2251 (31.02)	623 (27.68)	292 (12.97)	562 (24.97)
		P = 0.001	P = 0.02	P = 0.001
Community fertility				
Low	864 (11.91)	201 (23.26)	110 (12.73)	197 (22.80)
High	6392 (88.09)	2444 (38.24)	947 (14.82)	2162 (33.82)
		P = 0.001	P = 0.10	P = 0.001

Table 1. (continued)

Variable	Total Sample, n (%)	Stunted, n (%)	Wasted, n (%)	Underweight, n (%)
Availability of mothers club in the community				
No	5570 (77.24)	2072 (37.20)	821 (14.74)	1841 (33.05)
Yes	1641 (22.76)	551 (33.58)	226 (13.77)	502 (30.59)
		$P = 0.01$	$P = 0.32$	$P = 0.06$
Availability of NGOs membership				
No	160 (2.21)	68 (42.50)	14 (8.75)1	49 (30.63)
Yes	7096 (97.79)	2577 (36.32)	1043 (14.57)	2310 (32.55)
		$P = 0.11$	$P = 0.03$	$P = 0.60$
Health facility in this community				
No	96 (1.32)	35 (36.46)	9 (9.38)	26 (27.08)2
Yes	7160 (98.68)	2610 (36.45)	1048 (14.64)	2333 (32.58)
		$P = 0.001$	$P = 0.15$	$P = 0.25$

Abbreviations: AOR, adjusted odds ratio; BMI, body mass index; CI, confidence interval; HH, household; NGOs, nongovernmental organizations.

Discussion

Despite greater successes in improving all health indicators accomplished by Bangladesh, undernutrition is still a major concern for improving child health. We observed the prevalence of undernutrition along with potential determinants of undernutrition in Bangladeshi context, although childhood morbidity overall showed a steady decline over the decades.[26] This study has found the prevalence of stunting, wasting, and underweight among under-5 children as 36.45%, 14.57%, and 32.51%, respectively, which indicates childhood undernutrition in Bangladesh really needs urgent attention.

We observed that the age of the children, children with fever or diarrhea, type of birth, mother's education and BMI of the mother, household wealth, and the number of under-5 children in the household were significant risk factors for childhood undernutrition. This study also traced out various community-level factors, including the place of residence and administrative division, have effects on childhood undernutrition after controlling for the effects of individual-level and maternal/household-level variables. The study shows that the odds of being underweight increase with age. Some previous studies also found higher age-groups are often positively associated with stunting and wasting.[11,17,21] The insufficiency of appropriate supplementary food for the children above 6 months of age may be one of the reasons, as only mother's milk is not sufficient to maintain adequate nutrition after 6 months.[4,11] We found that that multiple births increased the likelihood of childhood stunting and underweight. Earlier studies documented that multiple births are associated with various health problems, including premature births, low birth weight, cerebral palsy, and inadequate breast-feeding, which can inhibit child growth.[4,12] We also observed that the presence of fever in the last 2 weeks preceding the survey appeared as a significant factor for childhood undernutrition, which also documented in earlier studies in resource-poor settings.[4,21] Indeed, there is a strong link between diarrhea and undernutrition; as such, infections lead to lower food intake, losses of nutrients, vomiting, poor digestion, and disturbance of

metabolic equilibrium, which may lead to childhood undernutrition.[4] The present study found that children of mothers who had no education or primary education are more likely to be stunted and underweight at $P < .01$ level. Many other previous studies also observed a negative link with higher education and malnourished child.[4,5,10-12,14,15,18,20,21] High maternal education can lower childhood undernutrition through improved knowledge of healthy behaviors and sanitation habits during nurturing their child.[4,5]

The study found that children who belong to the mothers with low nutritional status are more likely to have undernutrition, which supports the previous findings.[27,28] Further, the lactation capacity of underweight mothers may be limited due to their poor nutritional status.[27] Like other studies, we found that children who are from the poorest and poor households were more likely to be stunted, wasted, and underweight.[4,5,12,19,21] Previous study in these settings also observed that children of disadvantaged households often bear a greater burden of morbidity than the advantaged households.[23] Poverty may lead to childhood undernutrition through insufficient food intake, unhygienic living environment, and a lack of necessary health care due to affordability issues.[4] Like earlier studies of various settings, this study showed that the children from urban areas were less likely to be stunted compared to those from the rural region.[4,5,21] The study also found significant impact of administrative division and undernutrition, where children from Sylhet division have the highest likelihood of being stunted and underweight.[5,22] Sylhet is considered poor performing in some indicators like literacy rates (where the female literacy rate is even lower), high mortality rate, and high fertility rate.[22]

We observed that community index has a significant role in childhood stunting. It is well known that community with high index status is likely to represent better living conditions with higher accessibility, affordability, and awareness, which contributes to improved childcare and better feeding practices. Indeed, there are some spillover effects of community factors, for instance, if most persons in the community are aware of some nutritional issues, the remaining will also learn quickly

Table 2. Multivariate Analysis of Factors (Individual and Community Level) Influencing Childhood Undernutrition.

Variable	Model I (Stunted), AORs (95% CI)	Model II (Wasted), AORs (95% CI)	Model III (Underweight), AORs (95% CI)
Individual-level factors			
Sex of the child			
Female			
Male	1.08 (0.96-1.21)	1.14 (0.97-1.33)	0.98 (0.87-1.11)
Age of child			
<6 (ref)			
6-8	1.52[a] (0.98-2.38)	0.60[b] (0.39-0.93)	0.63[b] (0.41-0.97)
9-11	2.85[c] (1.89-4.30)	1.03 (0.71-1.51)	1.54[b] (1.06-2.22)
12-17	4.56[c] (3.16-6.56)	0.85 (0.61-1.19)	1.98[c] (1.43-2.73)
18-23	7.10[c] (4.94-10.22)	0.72[a] (0.51-1.03)	2.31[c] (1.67-3.18)
24-35	6.69[c] (4.76-9.40)	0.60[c] (0.44-0.83)	2.83[c] (2.11-3.78)
36-47	7.49[c] (5.33-10.53)	0.56[c] (0.41-0.77)	2.69[c] (2.01-3.61)
48-59	5.55[c] (3.95-7.80)	0.71[b] (0.52-0.97)	3.00[c] (2.24-4.01)
Type of birth			
Single birth (ref)			
Multiple birth	1.65[a] (0.96-2.85)	1.11 (0.51-2.40)	1.63[a] (0.95-2.81)
Birth order			
1 (ref)			
2-3	0.98 (0.86-1.12)	0.98 (0.83-1.18)	0.97 (0.84-1.11)
4-5	0.95 (0.77-1.17)	0.83 (0.62-1.10)	0.89 (0.72-1.10)
6 and above	1.23 (0.89-1.71)	1.09 (0.72-1.69)	0.86 (0.62-1.19)
Fever in the last weeks			
No			
Yes	1.19[b] (1.02-1.40)	1.27[b] (1.03-1.57)	1.29[c] (1.10-1.53)
Recent diarrheal disease			
No (ref)			
Yes	1.37[b] (1.04-1.80)	1.06 (0.75-1.51)	1.19 (0.91-1.57)
Acute respiratory infection			
No (ref)			
Yes	1.01 (0.85-1.19)	0.97 (0.77-1.19)	1.04 (0.88-1.22)
Maternal/HH-level factors			
Mother's education level			
No education	1.72[c] (1.27-2.32)	1.04 (0.71-1.52)	2.03[c] (1.49-2.78)
Primary	1.75[c] (1.33-2.29)	1.18 (0.84-1.65)	1.90[c] (1.43-2.52)
Secondary	1.29[b] (1.01-1.65)	1.00 (0.74-1.35)	1.41[c] (1.09-1.83)
Higher (ref)			
Mother's BMI			
Underweight	1.68[c] (1.36-2.06)	1.77[c] (1.34-2.32)	2.33[c] (1.89-2.88)
Normal	1.36[c] (1.15-1.60)	1.30[b] (1.04-1.63)	1.39[c] (1.17-1.65)
Overweight (ref)			
Number of under-5 children in the HH			
1 (ref)			
2	1.14[a] (0.99-1.31)	0.77[c] (0.64-0.94)	1.03 (0.89-1.19)
3	0.98 (0.73-1.31)	0.92 (0.62-1.36)	0.88 (0.65-1.19)
Access to safe drinking water			
Yes (ref)			
No	0.89 (0.58-1.36)	1.32 (0.78-2.24)	0.91 (0.60-1.40)
Wealth quintile			
Poorest	3.18[c] (2.41-4.19)	1.39[a] (0.97-1.99)	2.36[c] (1.79-3.12)
Poor	2.48[c] (1.91-3.23)	1.39[a] (0.99-1.95)	1.97[c] (1.51-2.56)
Middle	2.34[c] (1.84-2.98)	1.22 (0.90-1.67)	1.82[c] (1.42-2.32)
Richer	1.81[c] (1.46-2.26)	0.97 (0.73-1.30)	1.34[b] (1.07-1.68)
Richest (ref)			
Community-level factors			
Place of residence			
Rural (ref)			
Urban	1.32[c] (1.12-1.55)	0.89 (0.72-1.12)	1.09 (0.93-1.29)

Table 2. (continued)

Variable	Model I (Stunted), AORs (95% CI)	Model II (Wasted), AORs (95% CI)	Model III (Underweight), AORs (95% CI)
Division			
Barisal	1.53[c] (1.19-1.96)	1.11 (0.82-1.49)	1.11 (0.86-1.42)
Chittagong	1.67[c] (1.32-2.11)	0.89 (0.66-1.19)	1.31[b] (1.03-1.65)
Dhaka	1.48[c] (1.17-1.87)	0.79 (0.59-1.06)	1.05 (0.83-1.33)
Khulna	1.22 (0.95-1.58)	0.72[b] (0.52-1.00)	0.95 (0.74-1.23)
Rajshahi (ref)	1.00	1.00	1.00
Rangpur	1.26[a] (0.99-1.60)	0.91 (0.68-1.23)	1.04 (0.82-1.32)
Sylhet	2.20[c] (1.72-2.81)	0.55[c] (0.39-0.76)	1.26[a] (0.98-1.61)
Community wealth			
Low	1.06 (0.84-1.34)	0.85 (0.62-1.17)	1.09 (0.86-1.38)
Middle	1.04 (0.85-1.27)	1.07 (0.82-1.39)	1.12 (0.91-1.37)
High (ref)			
Community mother's education			
Low	1.23[a] (0.97-1.56)	1.01 (0.73-1.39)	1.05 (0.83-1.33)
Middle	1.04 (0.89-1.21)	1.01 (0.82-1.24)	1.03 (0.89-1.21)
High (ref)			
Community prenatal care			
Low	1.06 (0.69-1.62)	1.33 (0.78-2.27)	1.29 (0.85-1.95)
Middle	1.01 (0.82-1.24)	1.03 (0.78-1.35)	1.09 (0.89-1.34)
High (ref)			
Community skilled delivery			
Low	1.08 (0.90-1.31)	0.87 (0.68-1.13)	0.95 (0.78-1.15)
Middle	1.07 (0.91-1.26)	1.02 (0.82-1.26)	0.98 (0.83-1.16)
High (ref)			
Community fertility			
Low (ref)			
High	1.16 (0.93-1.46)	1.01 (0.76-1.33)	1.09 (0.86-1.37)
Availability of mothers club in the community			
Yes (ref)			
No	1.03 (0.89-1.19)	1.04 (0.86-1.26)	1.01 (0.87-1.17)
Availability of NGOs membership			
Yes (ref)			
No	1.29 (0.85-1.96)	0.64 (0.33-1.23)	0.86 (0.55-1.33)
Health facility in this community			
Yes (ref)			
No	1.62[a] (0.95-2.77)	0.92 (0.43-1.99)	1.37 (0.79-2.37)

Abbreviations: AOR, adjusted odds ratio; BMI, body mass index; CI, confidence interval; HH, household; NGOs, nongovernmental organizations.
[a]$P < .10$.
[b]$P < .05$.
[c]$P < .01$.

with community engagement. This study does not find any significant impact of community index on wasting and underweight, rather found strong evidence in case of stunting. While 2 other measures of undernutrition are important, stunting is regarded as the key indicators of undernutrition. It is also argued as long-term undernutrition and a body of literature focused on childhood stunting only as a nutritional indicator.[29,30,2,12,18,21] Since community factors are also something long-term phenomenon, it is not surprising to see that community status affects stunting, but not the other ones.

The study has several limitations. This study was based on cross-sectional data, and the old debate of causation and correlation still applies. Further, due to the unavailability of data on potential confounders (eg, childcare practices, food taboos, and behavior of the parents), these were not included in the

analysis, which might have altered the results. Further, the individual-level responses have been utilized to generate certain community-level factors, which might limit the results. However, our findings can be generalized at the national level as the study gathered data from a nationally representative latest household demographic and health survey that provided a more accurate picture in the country context.

Conclusions

Undernutrition is an important public health issue for children less than 5 years old in Bangladesh. The prevalence of childhood undernutrition is patterned by various factors such as age, type of birth, mother's education, mother's BMI status, wealth status, number of under-5 children in the household, the place

Table 3. Impact of Community Index on Childhood Undernutrition.

Variable	Model 1 (Stunted)	Wasting	Underweight
	AORs (95% CI)	AORs (95% CI)	AORs (95% CI)
Sex			
Female (ref)			
Male	1.08 (0.96-1.22)	1.13 (0.97-1.32)	0.98 (0.87-1.10)
Age of child			
<6 (ref)			
6-8	1.49[a] (0.96-2.32)	0.60[b] (0.39-0.92)	0.62[b] (0.40-0.96)
9-11	2.74[c] (1.82-4.11)	1.02 (0.70-1.49)	1.51[b] (1.04-2.18)
12-17	4.32[c] (3.01-6.20)	0.87 (0.62-1.21)	1.96[c] (1.42-2.70)
18-23	6.86[c] (4.78-9.84)	0.72[a] (0.50-1.02)	2.27[c] (1.65-3.13)
24-35	6.54[c] (4.67-9.16)	0.60[c] (0.44-0.82)	2.81[c] (2.10-3.75)
36-47	7.24[c] (5.16-10.14)	0.56[c] (0.41-0.77)	2.67[c] (1.99-3.57)
48-59	5.44[c] (3.89-7.63)	0.70[b] (0.52-0.96)	2.96[c] (2.22-3.96)
Type of birth			
Single birth (ref)			
Multiple birth	1.55 (0.90-2.66)	1.19 (0.55,2.56)	1.61[a] (0.93,2.77)
Birth order			
1 (ref)			
2-3	0.96 (0.84-1.10)	1.01 (0.85-1.20)	0.96 (0.84-1.10)
4-5	0.97 (0.80-1.19)	0.86 (0.65-1.13)	0.92 (0.75-1.13)
6 and above	1.40[b] (1.02-1.91)	1.07 (0.71-1.61)	0.95 (0.70-1.30)
Fever in the last weeks			
No (ref)			
Yes	1.21[b] (1.03-1.42)	1.26[b] (1.03-1.55)	1.30[c] (1.11-1.53)
Recent diarrheal disease			
No (ref)			
Yes	1.46[c] (1.11-1.91)	1.06 (0.74-1.50)	1.25 (0.95-1.64)
Acute respiratory infection			
No (ref)			
Yes	1.00 (0.85-1.18)	0.98 (0.79-1.21)	1.04 (0.88-1.23)
Mother's education level			
No education	1.85[c] (1.38-2.48)	0.98 (0.68-1.43)	2.09[c] (1.54-2.83)
Primary	1.88[c] (1.44-2.45)	1.13 (0.81-1.57)	1.94[c] (1.47-2.57)
Secondary	1.34[b] (1.05-1.71)	0.97 (0.72-1.30)	1.44[c] (1.12-1.87)
Higher (ref)	.	.	.
Mother's BMI			
Underweight	1.73[c] (1.41-2.12)	1.70[c] (1.30-2.22)	2.35[c] (1.91-2.89)
Normal	1.37[c] (1.17-1.61)	1.29[b] (1.03-1.60)	1.39[c] (1.18-1.65)
Overweight (ref)			
Number of under-5 children in the HH			
1 (ref)			
2	1.23[c] (1.07-1.40)	0.76[c] (0.63-0.92)	1.09 (0.95-1.25)
3	1.15 (.87-1.52)	0.86 (0.59-1.25)	0.97 (0.73-1.30)
Access to safe drinking water			
Yes (ref)			
No	1.03 (0.68-1.56)	0.82 (0.49-1.38)	1.02 (0.67-1.54)
Wealth quintile			
Poorest	2.52[c] (2.01-3.15)	1.47[b] (1.10-1.97)	2.25[c] (1.79-2.83)
Poor	1.99[c] (1.60-2.47)	1.51[c] (1.13-2.00)	1.88[c] (1.50-2.35)
Middle	1.96[c] (1.59-2.41)	1.34[b] (1.01-1.76)	1.77[c] (1.43-2.20)
Richer	1.62[c] (1.32-1.99)	1.05 (0.80-1.39)	1.31[b] (1.05-1.63)
Richest (ref)			
Community index	0.89[c] (0.83-0.95)	1.07 (0.98-1.17)	0.95 (0.89-1.02)
Observations	5564	5564	5564

Abbreviations: AOR, adjusted odds ratio; BMI, body mass index; CI, confidence interval; HH, household.
[a]$P < .10$.
[b]$P < .05$.
[c]$P < .01$.

of residence, administrative division, and community index. Thus, nutritional programs with effective multisectoral approaches might be designed and should be prioritized for tackling childhood undernutrition. Undeniably, a joint effort by the government, NGOs, and the community is necessary to improve the childhood nutritional status in Bangladesh.

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