Association Between Economic Inequality and Under-Five Child Malnutrition: Evidence from Bangladesh Demographic and Health Survey

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Abstract

Under-five child malnutrition is an important phenomenon in developing countries like Bangladesh. Historically certain privileged groups have been benefited by the improvements in economic conditions inflicting health care inequality among the population. This study attempts to examine the association between economic inequality of households and adverse under-five child malnutrition using information from 4,976 children aged 0 to 59 months of Bangladesh Demographic and Health Survey, 2014 data. A child is said to be an adversely malnourished if the growth rate is badly stunted i.e., if z-score of the measure height-for-age of a child is more than the two standard deviations under the median. Multivariate logistic regression is used to estimate the household's economic effect on the rate of adverse growth-stunting of children. The estimation results show that children from the poorest group are about four times more likely to experience malnutrition than the children from the richest group (OR = 4.32; 95% CI: 3.83, 5.07). The effects of economic status on childhood under-nutrition are also significant when the analysis is adjusted for child's age, gender, multiple birth status, antenatal care, skilled birth assistance, birth order number (OR=3.43; 95% CI: 3.04, 3.87); mother's BMI, mother's education level (OR=3.05; 95% CI: 2.71, 3.48); residence type, and geographic region (OR = 3.14; 95% CI: 2.74, 3.63). Hence, this study suggests that there is a statistically significant association between the household economic inequality and the growth rate stunting of children. Reduction of poverty and making social security services as well as maternal medical supports more available to the poor people are necessary to improve the overall under-five childhood malnutrition condition in Bangladesh.

I. Introduction

Under-five child malnutrition is one of the indicators that assesses the overall health status of the children of a country and it is interconnected with poverty. There is a significant improvement in under-five child mortality, malnutrition and poverty condition in many developing countries over the last decades[1-2]. In spite of these remarkable advancements, still many people are defenseless to under-nutrition, ill health, lack of food security etc[3]. These types of problems are serious especially in developing countries like Bangladesh which are struggling to escape the curse of extreme poverty. This may be due to the fact that the public health and nutritional advancements originated from economic growth is only focused among the certain privileged groups of the countries[4-5].

Malnutrition is one of the major causes of child mortality and morbidity in Bangladesh[6-7]. The combined effects of lack of sufficient food, repetitive incidents of infections and lack of adequate care at the period of sickness often cause malnutrition among children. Furthermore, malnutrition upsets physical growth, debilitates the internal immune system and enhances the risks of infections[8]. World Health Organization (WHO) identified malnutrition as leading cause of disease[9]. A number of research studies provide evidence that there is an association between under-five child malnutrition with child's gender, age, multiple-birth status, birth interval, mother's education and BMI, parent's health care seeking behavior like taking antenatal care and expert birth assistance at the time of delivery, rural residence, race or ethnicity, geographic division etc[10-13].

It is perceived that the countries with lack of economic equality have a tendency to have a poorer health status than the countries that have more economic equality[2,14]. Larger national affluence does not certainly ensure the better health care for the entire citizens. Hence maximization of financial growth should not the best method of advancing overall health care condition[15]. Previous research studies have demonstrated that the poorest household children have more chance to be undernourished than the richer household children[13,16-18]. But there is no conclusive association between child's malnutrition and household economic inequality yet. Hence, the main objective of this study is to examine the association between childhood malnutrition and household economic inequality. It also examine the effects of different other confounding risks factors on under-five childhood malnutrition.

II. Materials and Methods

Bangladesh Demographic and Health Survey (BDHS), 2014 data[19] are utilized for this study. The survey was conducted by National Institute of Population Research and Training (NIPORT) of the Ministry of Health and Family Welfare (MHFW) in Bangladesh. A research firm of Bangladesh located in Dhaka named Mitra and Associates implemented the overall survey and technical support was provided through the MEASURE DHS program by Macro International Inc., a private research firm located in Calverton, Maryland, USA. The U.S. Agency for International Development (USAID) provided financial support for the survey. Bangladesh was stratified into 20 strata where each stratum is considered as enumeration areas (EAs) while conducting the survey. A two-stage stratified random sampling procedure was followed. At the first stage of sampling, the survey randomly selected 600 EAs (among them 393 in rural areas and 207 in urban areas) applying probability proportional to the EA size. A systematic random sample of 30 households was selected on average from each EA in the second stage of sampling. Finally, the information

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of 17,863 ever-married women aged 12 to 49 year were collected from the selected households. The BDHS, 2014 also collected demographic, socioeconomic, and health-related information for the finally selected ever-married women. The main BDHS report provides details of the sampling design[20]. The analysis of this study is used information of 4,976 children with legal information on height or length. The children whose information was in valid or missing were excluded.

The survey used height or length of all 0–59 months' children to measure the nutritional status and physical growth of children. Three typical indices that define child's nutritional status are wasting (weight-for-height), underweight (weight-for-age) and stunting (height-for-age). However, only stunting is considered as an index of nutritional status of children in this study as it reveals the cumulative effect of enduring malnutrition and it does not fluctuate substantially on the basis of current dietary intake. World Health Organization (WHO) considered children as growth-stunted or under-nourished establishing a children's z-score measure (height-for-age) above two standard deviations less than the international standard of median[21].

Using principle component analysis, BDHS also measures wealth status of households which is evaluated from some asset variables and household characteristics[22]. The characteristics used to assess the household wealth status take account of having sanitation facility, electricity, safe drinking water, main wall material, roof material, floor material etc. The asset variables contain land ownership and different durable goods like wardrobe, watch or clock, chair, radio, bench, television, computer, bicycle, motorcycle, table, telephone, sewing machine etc[20]. In this current analysis this wealth index measure is considered as a substitution for economic status of households. Household economic inequality is calculated by separating this wealth index into five quintiles. The lowermost quintile presents the poorest 20% and the uppermost quintile presents the wealthiest 20% households in Bangladesh.

Economic status is associated with other demographic and socioeconomic factors which are also responsible to influence the nutrition of children. Hence the analysis of this study is adjusted for other possibly confounding factors. Those confounding factors are: multiple birth status (single, multiple), age of the child (0–11, 12–23, 24–35, 36–47, 48–59 months), gender (boy, girl), taking antenatal care (no, yes), availability of skilled birth attendant (no, yes), birth order number (1, 2, 3, 4+); mother's BMI index(kg/m2) (less than 18.5, 18.5 to 24.9, more than 25.0), maternal education level (no education, primary, secondary or higher); residence type (rural, urban) and geographical region (Barisal, Sylhet, Rangpur, Rajshahi, Khulna, Dhaka, Chittagong).

The effects of economic status and confounding factors on childhood malnutrition are estimated using multivariate logistic regression framework. The results of this study are represented as percentage of stunting with level of

significance (p-value) in univariate and bivariate analysis, and odds ratio with 95% confidence interval in multivariate analysis.

III. Estimation Results

The percentage distribution of the covariates and the rate of the prevalence of stunting are shown in Table 1. It is observed that about 22% children are from richest family, 19% from both rich and middle class family, 21% from poor family whereas 17% from poorest family. Marginally 1% of the children are multiple births and others are single birth. The distributions of the children are almost equal with respect to gender and age categories. About 40% mothers are able to receive antenatal care while 36% of them are capable to manage as killed birth attendant. Approximately 38%, 26%, 20% and 14% children are born as first order, second order, third order and other order birth respectively. Around 55% mothers have a normal body mass index whereas 36% and 8% are underweight and overweight respectively. In case of education about 15% of mothers do not have any formal education while 31% have primary and 53% have secondary or higher education. Most of the children live in rural area (68%) and other 32% children live in urban area. According to geographic region, about 19.90% of the children reside in the Chittagong division, about 16% in the Dhaka and Sylhet divisions, 11% in the Khulna and Barisal divisions and about 12% of them live in the Rajshahi and Rangpur division.

About 36% under-five children are the sufferer of adverse growth-rate stunting in Bangladesh (Table 1). The prevalence rate of under-five childhood adverse growth-stunting decreases as the household economic status rises. The prevalence of stunting is about 47% in the poorest households, 43% in poor households, 41% in middle class households, 35% in rich households and only 18% in richest households. The prevalence rate of chronic growth-stunting increases with the increase of child age and it is higher among the children of multiple births. The prevalence of stunting quickly rises between 12 to 23 months of age, after then it doesn't fluctuate significantly. One cause behind the low prevalence of stunting at the 0-11 months age group may be that within these months most of the babies are breastfed. The rate does not vary considerably by the gender of child. However, it is greater among the children whose mothers do not take antenatal care and give birth of their children without the presence of a skilled birth attendant. The rate is slightly higher among the children of fourth or higher order births. There is a significant negative relationship between the prevalence of stunting and mother's BMI, and mother's education level. If the maternal education level increases then the prevalence rate of growth-stunting will decrease. It is less in urban areas (32%) compared to the rural areas (38%). According to geographic location the stunting rate is higher at Barisal division (45%) and lowest at Khulna division (30%).

Table 1. Summary statistics of the covariates and prevalence of stunting by economic status and other selected covariates

Characteristic	Frequency	Percentage	Prevalence rate of stunting (%)	p-value
Bangladesh	4976		36.76	
Economic status				
Richest	1114	22.39	18.14	
Rich	952	19.15	35.96	
Middle	938	19.27	41.51	0.001
Poor	1086	21.83	43.00	
Poorest	866	17.41	47.05	
Multiple birth status				
Single	4922	98.92	36.08	0.001
Multiple	54	1.08	64.21	
Age of the child (months)				
0-11	1022	20.55	17.38	
12-23	1063	21.35	40.90	
24-35	988	19.86	42.79	0.001
36-47	915	18.38	43.56	
48-59	989	19.87	42.76	
Child's gender				
Male	2518	50.62	36.89	0.231
female	2458	49.38	37.96	
Antenatal Care				
No	2971	59.71	43.67	0.002
Yes	2005	40.29	26.44	
Skilled birth attendant				
No	3160	63.50	44.78	0.001
Yes	1816	36.50	23.34	
Birth order number				
1st	1325	38.69	36.23	
2nd	1331	26.75	34.56	0.001
3rd	1023	20.56	37.89	
Other	697	14.00	40.56	
Mother's BMI index(kg/m2)				
Less than 18.5	1808	36.33	43.65	
18.5 to 24.9	2750	55.27	34.97	0.001
More than 24.9	418	8.40	16.75	
Maternal education				
No education	761	15.30	48.78	
Primary	1563	31.40	39.43	0.001
Secondary or higher	2652	53.30	30.45	
Residence type				
Urban	1597	32.10	30.45	0.001
Rural	3379	67.90	39.67	
Geographic location				
Barisal	553	11.12	44.78	
Sylhet	802	16.10	31.56	
Rangpur	632	12.70	37.12	
Rajshahi	617	12.39	32.67	0.001
Khulna	558	11.20	29.23	
Dhaka	822	16.51	39.56	
Chittagong	992	19.90	40.76	

Association between economic status and adverse under-five childhood growth-stunting

The adjusted and unadjusted effects of economic status on adverse stunting are presented in Table 2. In Model 1 without controlling the other risk factors, the odds of having chronic growth-stunting are 4.32 times higher among the children who are living in the poorest houses than the children who are living in the richest houses (OR = 4.32;

95% CI: 3.83, 5.07). If economic status of a household increases then the odds of having childhood growth-stunting decreases. This association remains strong enough even when multiple birth-status of child, gender, age, antenatal care, the presence of skilled birth attendants and birth order number are controlled in Model 2 (OR=3.43; 95% CI: 3.04, 3.87). When these characteristics of children are controlled for the odds of experiencing adverse growth-stunting are about three and a half times higher in the poorest households compared to the richest households. On the other hand when mother's characteristics such as education level and BMI index are controlled in Model 3 the effect of economic status slightly reduces (OR=3.05; 95% CI: 2.71, 3.48). In the complete model, when all the child's, maternal and other characteristics are controlled, the effect of household economic status on adverse growth-stunting of under-five children remains statistically significant (OR = 3.14; 95% CI: 2.74, 3.63).

Table 2. Estimated effects of economic status and different other selected covariates on adverse under-five childhood growth-stunting

Characteristics	Odds Ratio (95 % CI)			
	1st Model	2nd Model	3rd Model	4th Model
Economic status				
Richest (Ref.)				
Rich	2.54 (2.14,2.90)	2.17 (1.89,2.63)	2.08 (1.74, 2.53)	2.12 (1.74, 2.51)
Middle	2.89 (2.32,3.19)	2.64 (2.12,2.98)	2.53 (2.05, 2.87)	2.63 (2.24, 2.97)
Poor	3.29 (3.05,3.74)	3.02 (2.67, 3.48)	2.77 (2.31, 3.01)	2.70 (2.19, 3.15)
Poorest	4.32 (3.83,5.07)	3.43 (3.04, 3.87)	3.05 (2.71, 3.48)	3.14 (2.74, 3.63)
Multiple birth status				
Single (Ref.)				
Multiple		3.43 (2.95, 3.98)	2.92(2.43, 3.39)	2.89 (2.27, 3.48)
Age of the child (month)				
0-11 (Ref.)				
12-23		3.82 (3.06, 4.27)	5.05 (4.14, 6.76)	4.36 (3.61, 5.02)
24-35		2.88 (2.07, 3.51)	4.06 (3.33, 4.89)	4.14 (3.69, 4.98)
36-47		3.02 (2.49, 3.65)	3.07 (2.67, 3.71)	3.71 (3.07, 4.63)
48-59		4.13 (3.47, 4.86)	4.25 (3.83, 4.94)	4.12 (3.70, 4.88)
Child's gender				
Male (Ref.)				
Female		1.06 (0.92, 1.17)	1.03 (.89, 1.13)	1.21 (1.03, 1.32)
Antenatal Care				
No (Ref)				
Yes		0.64 (0.49, 0.78)	0.59 (0.44, 0.72)	0.78 (0.53, 0.90)
Skilled birth attendant				
No (Ref.)				
Yes		0.49 (0.36, 0.74)	0.72(0.56, 0.91)	0.86 (0.68, 1.02)
Birth order number				
1st (Ref.)				
2nd		0.91 (0.78, 1.13)	0.82 (0.64, 1.02)	1.09 (0.84, 1.34)
3rd		1.07 (0.89, 1.32)	1.03 (0.79, 1.21)	0.90 (0.71, 1.11)
Other		1.14 (0.93, 1.33)	1.32 (1.06, 1.65)	1.23 (1.05, 1.47)
Mother's BMI (kg/m2)				
18.5 to 24.9 (Ref.)				
Less than 18.5			2.04 (1.53, 2.44)	1.88 (1.34, 2.51)
More than 24.9			0.71 (0.35, 0.90)	0.63 (0.38, 0.88)
Maternal education				
No education (Ref.)				
Primary			0.90 (0.75, 1.05)	0.92(0.79, 1.07)
Secondary or higher			0.68 (0.57, 0.89)	0.65 (0.51, 0.82)
Residence type				
Urban (Ref.)				
Rural				0.76 (0.61, 0.89)
Geographic location				
Barisal (Ref.)				
Sylhet				0.84 (0.61, 1.09)
Rangpur				0.83 (0.71, 0.94)
Rajshahi				0.73 (0.52, 0.84)
Khulna				0.91 (0.70, 1.10)
Dhaka				0.78 (0.61,0.97)
Chittagong				0.87 (0.66, 1.14)

IV. Discussion and Conclusion

The under-five child malnutrition is a susceptible indicator of the overall nutrition and health condition of a country. It is a development indicator as it measures the standard of life and it portrays the strength of development all together governed by low socio-economic status and poverty[23]. It is essential to study malnutrition on a continuous basis since it replicates the cumulative result of health, socio-economic and nutritional shortcomings and which may change over time.

The results of this study indicate that children within wealthier households are at a very lower threat of being malnourished compared to the children within less wealthy households. Children from the poorest families are at over four times the chance of being suffered from severe growth rate stunting of under-five children than the children of the richest households. The result does not dependent on child's age, sex, birth status, birth order number, receiving antenatal care, mother's education and BMI and other vital factors. These findings agree with the findings from previous research[4,17,6,12] and give further indication that household economic inequality is a potential risk factor for chronic under-five childhood malnutrition.

There is no significant difference in adverse growth-stunting between male and female which illustrates the absence of gender bias in health-related care and feeding for under-five children in Bangladesh. An upward pattern of growth rate stunting by age categories is similar with the usual upward pattern of occurrence of under-five childhood diseases with the increase of age[18]. This may partially be as a result of the starting of feeding outside foods around the age of 6 months, which enhances the probability of consuming unhygienic foods and eliminates the natural protection of child provided by mother's breast milk. Besides, at this age children start wandering outside and are more chance to be carried outer that may harm them to further diseases. Consistent with earlier research study, children of single-births have more chance to be nourished than the children of multiple births[24]. The relationship between higher-order births and adverse growth rate stunting may be because of the struggles for food existing within a household which is more likely in those households where more number of children is present and it is analogous to earlier findings[6]. Mother's education level which can also influence household income is described as one of the key factors for influencing a family's health and nutritional status in many previous studies[7, 13]. This study also gets the similar result.

There is a potential limitation of using cross sectional design in this study. Besides, this study may be denounced for not applying direct measure of household economic asset. However, it is difficult to collect dependable household income and expenditure data in developing countries like Bangladesh. Hence in this study an asset-based measure is used a best proxy for household economic status. Apart from these limitations, this study demonstrates that there is a statistically significant between economic status and under-five childhood growth-stunting and others important factors.

Thus it suggests that the improvement of malnutrition condition of the under-five children in Bangladesh may be achieved through integrating and expanding extensive nutritional programs and community health targeting the poor.

The results of this research reveal that there are wide scopes for increasing child nutrition in Bangladesh. To reduce the risk of malnutrition among children, it is absolutely essential a combined efforts of government and non-governmental institutions to improve the child nutritional status. Besides the ongoing programs for child health development, the government may conduct some targeted nutrition strategies to improve nutritional status. Moreover, government may take necessary steps to substantiate the easier access to health information centers and special care should be given to helpless poorest people of the society. Healthy mothers are capable to give births of healthy children. Thus for the purpose of promoting the child nutritional status, the concentration of interventional programs should be provided to the children and their mothers together. The authors intend to recommend that health and nutrition education need to be integrated as a basic part of the whole education system.

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