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Does Community Facility Play a Vital Role on Nutrition Status of Under-Five Children in Bangladesh?

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Abstract

Community facilities are found to play an important role to improve the health status of children in many developing countries. In this paper, an attempt has been made to examine whether community facilities have impact on the nutrition status of under-five children in Bangladesh using ordinal logistic regression model. Data extracted from Bangladesh Demographic and Health Survey (BDHS), 2011 have been used for the purpose of analysis. Though unadjusted impact of community facilities on nutrition status of children was found be significant, it diminishes when controlled for demographic and socio-economic factors.

Key Words: BDHS, Community facility, Malnutrition, Ordinal logistic regression model, Stunting.

I. Introduction

Malnutrition is a widespread public health problem in developing countries and its prevalence is the highest among the under-five children as they are the most vulnerable part of a society. Malnutrition is defined as the cellular imbalance between the supply of nutrients and energy and the body's demand for them to ensure growth, maintenance and specific functions [1]. Now-a-days, child malnutrition continues to be a major challenge in Bangladesh though there have been several government programs in place to improve the situation. It is now well established that malnutrition among children is associated with inadequate nutrient intake, illness, socio-economic, demographic, maternal, and behavioral factors [2-5]. The biggest contributor of under-five child mortality is child malnutrition because malnourished children experience developmental delays and weight-loss as a result of inadequate intake of protein, calories and other nutrients. Malnutrition have negative effects on brain development causing delays in motor and cognitive development, such as: attention deficit disorder, impaired school performance, decreased IQ scores, memory deficiency, learning disabilities, reduced social skills, reduced language development, reduced problem-solving abilities [6].

Malnutrition among children may also be associated with socio-economic, demographic, maternal, and behavioral factors and is a result of inadequate nutrient intake and illness. In a few studies, it was found that demographic and socio-economic factors such as mother's age at birth, child's age, maternal education status, region, wealth index, birth order number, place of delivery, access to electricity, employment status of female headed households, ANC visits by doctor/nurse/any other health expertise, exposed to media etc. may play important role in influencing the child health status [2, 7-9].

In literature, a number of studies have been found that address the role of communication services on maternal and child health. To protect and prevent health in poor community, it is essential to combine community and facility based activities with the support from central level organizations. On the other hand, community services widely depend on the level of development (i.e. development of communication and health services) and on many local factors. Lack of communication facility and health facilities may discourage community members to make use of health facilities. Chikhungu et al. 2014 and Mokgatlhe and Nnyepi 2014 argue that implementation of strategies that empower community and household economically can effectively reduce the burden of childhood malnutrition. Availability of communication facility can help in the establishment of community daily market and to promote household income generating activities. In a study conducted in western Kenya, it was found that increase in distance of residence from community clinic decreases the rate of clinic visit substantially [10].

In this paper, an attempt has been made is to examine how community facilities contribute to the nutritional status of under-five children controlling demographic as well as socio-economic variables. Three standard indices that describe the nutritional status of a child are height-for-age (stunting), weight-for-height (wasting) and weight-for-age (underweight). In this study, only stunting has been considered as an indicator of nutritional status of children because it reflects the cumulative effect of chronic malnutrition and it does not vary considerably according to the recent dietary intake. Main access road to the community is used as a proxy variable for communication facility. Variables used for the purpose of health facility are availability of health facility in the community and time to reach to the health facility.

This paper is organized as follows. In Section II, the methodology is described, which includes the description of socio-economic, demographic factors and community facilities in BDHS, 2011. Results obtained from univariate analysis, bivariate analysis and ordinal logistic regression models are described in Section III. This paper concludes in Section IV with a short discussion.

II. Methods

Data

The study has utilized the nationwide data obtained from BDHS, 2011[11], where the data set was collected from a two-stage stratified sampling procedure. In the first stage, 600 clusters were selected from both the rural (393 clusters) and urban areas (207 clusters) of the country and in the second stage of sampling; a systematic sample of 30 households was selected on average from each enumeration area. A total

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of 17842 ever married women of age 12-49 from the selected households were interviewed to collect data on a complete history of their live births, including the sex, month and year of each birth, survival status and age at the time of the survey or age at death along with socio-economic and demographic variables. Moreover, information on community facilities was collected from Community dataset. According to BDHS 2011, community is defined as a cluster including union, ward and village/ moholla. Information regarding the most common type of transport, main access road to the community, main economic activities, availability of electricity and telephone service, primary source of water, availability of hospitals, availability of doctors and pharmacies, time to reach to the health facility etc. was collected. In this paper, information on main access road to the community, availability of health facilities and time to reach to the health facility was considered for analysis purpose. Other information was not considered because for most of the covariates this was found missing. The Community Questionnaire was administered in each of the selected clusters during the household listing operation in BDHS, 2011. A group of informants in each cluster, including the chairman or members of the union council, the ward commissioner, village/mohalla heads, teachers, imams, and female opinion leaders were administered by the Community Questionnaire.

The main focus of this paper is on the malnutrition status of under-five children in Bangladesh. In the analysis, to collect the malnutrition status, we have considered children who were born preceding five years of the survey. Finally, a total of 7646 children were selected who have complete information on malnutrition status and selected socio-economic and demographic characteristics along with community facilities considered in this study.

Variables

To reflect the cumulative effect of chronic malnutrition on child, the most widely used index is the stunting. Stunting of a child measured with height-for-age represents the linear growth. To compute this index, first the outcome variable, height-for-age, was standardized using the WHO Anthro software. A child who is more than two standard deviations below the median (-2 SD) of the WHO reference population in terms of height-for-age is considered as short for his or her age, or stunted. If a child is below three standard deviations (-3 SD) from the reference median, then the child is considered severely stunted. For all other values, a child is not stunted. In this paper, stunting is considered as ordinal response variable having three ordered categories: not stunted, stunted and severely stunted.

On the basis of literature review on nutritional status of under-five children, [12-20] the demographic factors considered in this paper are: age of mother's at birth of index children in years (<20, 20-35, >35), mother's education level (No, primary, secondary, higher), region (Barisal, Chittagong, Dhaka, Khulna, Rangpur, Rajshahi, Sylhet), birth order number (first birth, other) and the socio-economic factors are wealth index (poor, middle, rich), place of delivery (hospital, others), exposure to media (yes, no), ANC visits by doctor/nurse/any other health expertise (yes, no). Moreover, from community data, availability of health facility in the community (yes, no) and time to reach to the health facility (below one hour, one hour and above) are considered as health facilities. The variable main access road to the community, considered as communication facility, is categorized as all-weather road, seasonal road and others, where all-weather road includes pacca road or motor-able road, seasonal road includes earthen road.

Statistical Analysis

For the purpose of analysis, three major steps have been performed in this study. Percentage distribution of each category of the selected variables is given to show the pattern of the data on demographic, socio-economic factors and community facilities. Then Chi-square test is performed to identify unadjusted potential factors associated with stunting. Finally, ordered logistic regression models are fitted to the data, considering stunting as ordered responses (not stunted, stunted and severely stunted) to find out the adjusted effects of covariates.

To analyze the data in this paper, STATA 12.1 has been used and data are adjusted for sampling design including the sampling weights. At the stage of analysis, sampling design adopted by BDHS, 2011 was considered, where enumeration area was primary sampling unit and urban city corporation, urban other than city corporation and rural in each division were considered as strata. For considering the sampling design, STATA command *svyset [pweight=wt], psu(cluster) strata(stratification used in sampling design)* command has been used. For bivariate analysis, *svy:tab* and to perform ordinal logistic regression model, *svy:ologit* commands were used.

Ordinal Logistic Regression Model

To find out the adjusted effects of selected covariates on the stunting of a child, ordinal logistic regression model was fitted as stunting of child is considered as dependent variable having three ordered categories. One of the advantages of using this model is that regression coefficients of the covariates are independent of the levels (categories) and these coefficients can easily be converted to odds ratios [21]. Note that Cumulative logit link function is usually used to construct the ordinal logistic regression model. Suppose that ordered categorical response variable has J categories. Let, $Y_i\, ; i = 1,2, \ldots n$ be the response obtained from *ith* individual, and $x_i = (x_{i1}, \ldots x_{ik}, \ldots x_{iK})'$ be the (K×1) vector of covariates and $\beta = (\beta_1, \ldots \beta_k, \ldots \beta_K)'$ be the (K×1) vector of regression parameters. Suppose that for the *jth* category, $j = 1,2, \ldots J-1$, the odds, denoted by θ_{ij}, $j = 1,2, \ldots J-1$, is defined as $\theta_{ij} = \frac{Pr(Y_i \geq j)}{Pr(Y_i < j)}$. Therefore, the ordinal logistic regression model can be written as $\ln(\theta_{ij}) = \alpha_j + \beta' x_i$, where, α_j is the threshold term for the *jth* category. One may compute the odds ratio for the covariate x_k using expression $\exp(\beta_k)$. To select the covariates for the analysis, in this paper, at first bivariate analysis has been conducted to examine the association of selected covariates with the categorical ordered response variable stunting. The covariates found to have significant association were only considered in the regression analysis.

III. Results

Univariate analysis

It is observed that more than half of the children (58.63%) are not stunted, while 26.09% of children are stunted and 15.27% of children are severely stunted. More than half of the mothers (65.24%) gave their birth when they were in age group 20-35, while 31.28% of mothers gave birth at their young age (age less than 20 years) and 3.48% of mother's age at birth was 35 years or more. Among all women, 20.03% have no education, while 30.66% percent completed primary and 42.33% completed their secondary education. Moreover, there are a few women (6.98%) who completed their higher education. Most of the respondents are from Dhaka division (31.31%), whereas lowest numbers of respondents from Barisal division (5.41%). Most of the children are from poor families (43.98%), 19.44% from middle class and 36.58% from rich families. It is also observed that 34.71% of the children are the first babies of their mother. Among all births, 24.52% of the birth has been taken place in hospital or clinic. However, a large number of women (75.48%) have not got the hospital or clinic facility for their child delivery. Among all mothers, 43.59% mothers were taking ANC visits by doctors/ nurse/ paramedic/ family welfare during pregnancy, whereas 43.59% were not. A large number of mothers (62.95%) were found to be exposed to media. Among the children considered in the sample, 77.97% of them have health facility in their community. The distribution of respondents with respect to main access road to the community was 66.74%, 27.59% and 5.67% for the all weather road, seasonal road and other road, respectively. Regarding the time to visit health facility, 51.68% of respondents reported that required time is more than one hour.

Bivariate Analysis

An attempt has been made to find out the association between selected community facilities, demographic and socio-economic characteristics with stunting. The chi-square test is used to determine whether a specific covariate is

Table 1. Percentage distribution of stunting by selected demographic, socio-economic and community facility covariates

Covariates	Stunting			p-value
	Not stunted	Stunted	Severely stunted	
Mother's age at birth				
Below 20	56.63	27.44	15.93	
20-35	60.00	25.36	14.64	0.01
Above 35	51.02	27.78	21.20	
Maternal education				
No	48.85	29.12	22.03	
Primary	52.96	28.87	18.17	<0.001
Secondary	64.17	24.39	11.44	
Higher	78.06	15.53	6.41	
Region				
Barisal	55.33	24.62	20.06	
Chittagong	58.82	25.09	16.09	
Dhaka	56.38	27.95	15.67	
Khulna	66.28	22.99	10.73	<0.001
Rajshahi	66.08	25.05	8.87	
Rangpur	57.20	26.54	16.26	
Sylhet	50.01	27.45	22.54	
Wealth Index				
Poor	49.82	29.31	20.87	
Middle	59.65	26.17	14.18	<0.001
Rich	68.68	22.19	9.13	
Birth order				
First birth	62.21	24.93	12.86	<0.001
Others	56.73	26.71	16.56	
Place of delivery				
Hospital/Clinic	69.71	20.35	9.94	<0.001
Others	55.03	27.96	17.01	
ANC visits				
Yes	66.91	22.45	10.64	<0.001
No	52.23	28.91	18.86	
Exposed to media				
Yes	63.35	24.57	12.08	<0.001
No	50.61	28.67	20.71	
Availability of health facility				
Yes	58.61	25.64	15.75	0.18
No	58.71	27.7	13.59	
Time to reach health facility				
Below 1 hour	60.48	25.77	13.75	
1 hour & above	56.90	26.39	16.70	0.02
Main access road				
All weather	60.69	25.55	13.77	
Seasonal	55.91	26.72	17.37	<0.001
Other	47.66	29.50	22.84	

significantly associated with the child health status. The results are given in Table 1.

From the Table 1, it is found that time to reach to health facilities from the community and main access road to the community are significantly associated with child stunting. The percentage of stunting and severely stunting children are 26.39 and 16.70 whose mothers take time one hour or more to reach health facilities, whereas the percentage stunting and severely stunting children are 25.77 and 13.75 whose mothers take time below one hour. Moreover, the percentage of stunting and severely stunting children for the community with all-weather road are 25.55, 13.77, for seasonal road are 26.72, 17.37 and for other roads are 29.50, 22.84, respectively. It is found that the percentage of stunting and severely stunting children were lowest in all-weather road and highest in other roads.

It is observed that stunting and severely stunting are highest for children whose mother's age at birth were above 35 and lowest for children whose mother's age at birth were 20-35. Mother's level of education has an inverse relationship with stunting levels. Child stunting and severely stunting decrease as mother education increases. For example, child stunting is highest (29.12%) among the children whose mothers have no education. Moreover, the percentages of stunting for primary, secondary and higher educated mothers are 28.87, 24.39 and 15.52, respectively. Similar large differential also exist among the categories of wealth; as wealth increases, the extent of stunting and severely stunting among children decrease. It is observed that stunting is lowest in Khulna and severely stunting is lowest in Rajshahi compared to other divisions. Stunting and severely stunting are lower for the children who were the first babies of their parents. Moreover, Children who were born in hospital/clinic are less likely to be stunted and severely stunted compared to the children born in home or other places. Stunting and severely stunting are higher for the children whose mothers did not take antenatal visits by doctors/ nurse/ paramedic/ family welfare visitors during pregnancy. Moreover, stunting and severely stunting is inversely related to the children whose mothers were exposed to media.

It is clear from Table 1 that all covariates except availability of health facility in the community were found to have significant association with stunting of under-five children as p-values were less than 0.05.

Ordinal Logistic Regression Model

To examine the impact of community facilities (communication and health facilities) on nutrition status of under-five children controlling other factors, ordinal logistic regression models have been used as the outcome variable is ordered categorical variable. For this purpose, three models were considered. In Model 1, only community facilities were considered as covariates. To examine how demographical covariates change the influence of community variable, in Model 2, demographic variables were considered along with covariates considered in Model 1. Socio-economic covariates were included in Model 2 to construct Model 3. Estimated odds ratio (OR) and p-values obtained from these three models were given in Table 2.

From Model 1, it is clear that main access road to community is an important factor as p-values are less than 0.05. Children in a community where main access road is seasonal or other type are significantly less likely to be not stunted or stunted compared to the children from a community where main access road is all weather roads. The odds ratio for seasonal road and other are found to be 1.21 (p-value=0.02) and 1.68 (p-value < 0.01) respectively. The odds of being severely stunted is 21% higher for a child from a community with seasonal main access road compared to a child from a community with all weather road, whereas it is 68% higher for community with other type main access road. After controlling for main access road to the community, the covariate time to reach to health facility was found to have no significant impact on child stunting.

From Model 2 considering community facilities and demographic factors as covariates, it can be observed that children whose main access road to the community is seasonal roads (OR=1.17, p-value=0.03) and other roads (OR=1.31, p-value=0.07) are significantly more likely to be severely stunted compared to the children from community with all-weather roads. However, time to reach to the health facility have insignificant association (OR=O.95, p-value=0.49) on stunting. It is important to notice that the odds ratios for seasonal and other are 1.17 and 1.31 in Model 2, respectively, whereas these are 1.21 and 1.68 in Model 1. It implies that the influences of community services reduce significantly after controlling for demographic variables. Children whose mothers gave birth at their age between 20-35 years are less likely to be severely stunted (OR=0.72, p-value<0.01) compared to the children whose mothers age at birth were below 20 years. However, children whose mothers age at birth is above 35 years are found to have statistically insignificant association on stunting compared to the children whose mothers age at birth is below 20 years. Children of mothers having completed primary (OR=0.84, p-value=0.03), secondary (OR=0.55, p-value<0.01) and higher (OR=0.31, p-value<0.01) education are significantly at a lower risk of stunting relative to the children of mother having no education. It reveals that severely stunted occurs more likely for children whose mothers are uneducated compared to children of educated mothers. It is observed that children from Khulna (OR=0.65, p-value<0.01) and Rajshahi (OR=0.53, p-value<0.01) are less likely to be severely stunted than children from Barisal and both regional group provides significant influence on stunting. For the birth order number, child who is the first baby (OR=0.79,

Table 2. Estimated odds ratio (OR) of selected demographic, socio-economic and community facility covariates obtained from ordinal logistic regression models for stunting

Covariates	Model 1		Model 2		Model 3	
	OR	p-value	OR	p-value	OR	p-value
Intercept 1	1.45	<0.01	0.60	<0.01	0.57	<0.01
Intercept 2	5.75	<0.01	2.46	<0.01	2.36	<0.01
Main access road						
All weather (RC)						
Seasonal	1.21	0.02	1.17	0.03	1.08	0.28
Other	1.68	<0.01	1.31	0.07	1.14	0.41
Time to reach health facility						
Below 1 hour	0.90	0.11	0.95	0.49	1.04	0.55
1 hour & above (RC)						
Mother's age at birth						
Below 20 (RC)						
20-35			0.72	<0.01	0.76	<0.001
Above 35			0.79	0.12	0.84	0.29
Maternal education						
No (RC)						
Primary			0.84	0.03	0.95	0.49
Secondary			0.55	<0.01	0.76	<0.01
Higher			0.31	<0.01	0.55	<0.01
Region						
Barisal (RC)						
Chittagong			0.83	0.12	0.91	0.42
Dhaka			0.87	0.22	0.97	0.78
Khulna			0.65	<0.01	0.72	<0.01
Rajshahi			0.53	<0.01	0.58	<0.01
Rangpur			0.85	0.15	0.84	0.12
Sylhet			1.09	0.48	1.17	0.17
Birth order						
First birth			0.79	<0.01	0.84	0.01
Others (RC)						
Wealth Index						
Poor (RC)						
Middle					0.79	0.01
Rich					0.64	<0.01
Place of delivery						
Hospital/Clinic					0.86	0.06
Others (RC)						
ANC visits						
Yes					0.79	<0.01
No (RC)						
Exposed to media						
Yes					0.88	0.05
No (RC)						

*RC: reference category; Model 1 considers only community facilities variables; Model 2 considers community facilities and demographic variables; Model 3 considers community facilities, demographic and socio-economic variables as covariates

p-value<0.01) of his/her mother is less likely to be severely stunted and it is a significant factor for stunting.

From Model 3, considering community facilities, demographic factors and socio-economic factors as covariates, it is observed that main access road to the community has not been found to have significant association on child nutrition status; though in Model 1 and Model 2 it was found to have significant association. Influences of demographic variables in Model 3 are similar to that found in Model 2. Children from middle class (OR=0.79, p-value=0.01) and rich (OR=0.64, p-value<0.01) families are significantly less likely to be severely stunted compared to the children from poor families. Children who were born in hospital (OR=0.86, p-value=0.06) are significantly at a lower risk of stunting relative to the children who were born in other places. It can be observed that children whose mothers have taken ANC visits by trained personnel during pregnancy (OR=0.79, p-value<0.01) are less likely to be severely stunted compared to the children whose mothers did not take ANC visits and it also provides significant association on stunting. Moreover, children whose mothers are exposed to media (OR=O.88, p-value=0.05) are significantly less likely to be severely stunted compared to the children whose mothers are not exposed to media.

IV. Discussion

The study of stunting of under-five children becomes one of the most important research topics of the developing countries including Bangladesh because of high level of stunted children. However, Bangladesh has witnessed a large decline in stunting during the last decade (BDHS, 2011). Stunting is considered as an important indicator of child nutrition status and it is a composite index reflecting social, economic, health care facilities as well as family and community customs and practices on the other.

In this paper, the main purpose is to examine the contribution of community facilities to the nutrition status of under-five children in Bangladesh using ordinal logistic regression models. Though in bivariate analysis, it is found to have significant association between community facilities (main access road to the community and time to reach to health facility) and child nutrition status, while controlled for demographic and socio-economic variables, the influence of community facilities diminishes, which is similar to the results found in a study conducted in Malawi [2]. The lack of significant association of community facilities with child nutrition status could be due to the fact that (i) these facilities may be of poor quality and therefore, its presence does not play a role for the welfare of children and (ii) socio-economic variables (wealth index, ANC visits, place of delivery, exposed to media) taken into account in the modeling have a stronger contribution to the nutrition status of children than community facilities. These socio-economic variables were also found to be significant factors for the child nutritional status in some studies [22-26].

It is revealed from this study that the community facilities are still in a rudimentary state because these facilities are so limited to improve nutrition status of under-five children in Bangladesh. Therefore, it is essential to take necessary steps to increase the community facilities so that community facilities can play an important role for the betterment of children. For this purpose, government and other stakeholders should fund and administrate different community system activities such as establishment of well-developed physical infrastructure, improving facilities in the existing health centers, establishing new community health clinics and availability of public transportation.

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