Socioeconomic Determinants of Diarrhea among Under-Five Children in Bangladesh: Do Education and Wealth Matter?

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ABSTRACT

Background: The purpose of this study is to assess the current status of diarrhea among the under-five children in Bangladesh by exploring the risk factors which are associated with this disease.

Subjects and Method: In this study, a nationally representative cross-sectional data had been used and the sample of women having under five children was selected by using a two stage stratified sampling method. A total of 7410 under five children were included. The dependent variable of this study was the status of diarrhea disease in the two weeks preceding the survey. The independent variable was education-wealth composition along with some other important variables such as age of children, delivery by caesarean section, migration status, mother's age at birth, type of residence, source of toilet facility, sources of drinking water. The bivariate analysis was chi-square. The multivariate analysis was a multiple logistic regression.

Results: According to this research study, education and wealth didn't show any impact individually in the logistic regression model but when we excluded education and wealth from the model and create it is composition, it worked as a significant influential factor of diarrhea disease in Bangladesh. Women who were literate and their wealth status was not rich (OR= 0.64; 95% CI= 0.43 to 0.96; p= 0.030), women who were literate and rich (OR= 0.55; 95% CI= 0.35 to 0.88; p = 0.012) had significant association with childhood diarrhea. In addition to that only children age between 6-23 months (OR= 3.49; 95% CI= 2.23 to 5.48; p<0.001) and 24-35 months (OR= 1.75; 95% CI= 1.08 to 2.85; p= 0.023) worked out as a significant predictor of childhood diarrhea.

Conclusion: This study was expected to help to build up a proper understanding about the socio-economic factors in order to reduce the childhood diarrhea in Bangladesh.

Keywords: under-five children, childhood diarrhea, education-wealth composition, socioeconomic

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BACKGROUND

Diarrhea diseases appear as one of the well-known health issues for children in the developing countries like Bangladesh. Diarrhea is the second leading cause of death for children under age five (Liu et al., 2012). Under-five child diarrhea incidence is widely regarded as a quality indicator of socio-economic development of a country's health care system and it reflects the quality of life (Tetteh et al., 2018). Every year approximately 500,000 diarrhea-related deaths occur worldwide where most of the occurrence found among the young

children in developing countries (Minh-Ha, 2020). People living in developing countries have the impoverished access to water supply, sanitation facility, social infrastructure, lack of awareness which have increased risk of occurring diarrheal diseases. According to the "Pneumonia & Diarrhea Progress Report 2020", Bangladesh has one of the highest number of pneumonia and diarrhea deaths among children under five years of age and almost 21,166 children died every year (Arvelo et al., 2010).

Through some basic intervention of socioeconomic factor many more children could be however saved in an initial state (Unicef, 2016). The prevalence of diarrheal disease demonstrated the relationship between diarrheal morbidity and different socioeconomic factors (Yilgwan and Okolo, 2012). The frequency of disease outbreaks is related to the environmental factors in addition to some socioeconomic factors. Incidence of diarrhea considered as a huge burden for children in low-and middle-income countries because of some multiple determinants like early child age, low socio-economic status and mother education, lack of safe drinking water, inadequate sanitation and poor hygiene, crowding and low maternal age (Agustina et al., 2013). According to a literature the occurrence of diarrhea is significantly lower among the children of highly educated mothers (Yilgwan and Okolo, 2012). That means educated mothers are expected to be more concern about the significance of hygiene, better childcare and feeding contemplation and disease causation factors and preventive measures (Peace, 2018). A good number of social factors such as lack of pure water, insufficient toilet facilities, and household's poor wealth index are mostly responsible for diarrhea-related disease burden which leads to the death.

Incidence and risk factors working behind the diarrhea diseases in early infancy are shown in several previous studies (Yilgwan & Okolo, 2012; WHO, 2009; Mihrete et al., 2014; Karambu et al., 2013; Maponga et al., 2013). According to the BDHS 2017-2018some important factors such as: source of drinking water, type of toilet facility, place of residence, mother's education and household wealth failed to explain the occurrence of diarrhea disease among under five children in Bangladesh (NIPORT, 2020).

In addition to that we have employed a logistic regression model with the above important covariates for determining the factors of diarrhea disease. However we didn't find any significant influence of the socioeconomic variables like education and wealth index and the environmental variables like type of toilet facility and source of drinking water on the childhood diarrhea. But education and wealth index both are important socioeconomic factors that are found to be significant predictors of childhood diarrhea in many previous literatures (Siziya et al., 2009; Woldu et al., 2016; Dessalegn et al., 2011; Mihrete et al., 2014; Ganguly et al., 2015; Mohammed et al., 2013; Yilgwan & Okolo, 2012).

Therefore these two variables should have influence on diarrheal disease in other dimension. In this study we attempt to explore whether the role of education among the respondents of different household economic status had any impact on the occurrence of childhood diarrhea. For this purpose a composite factor had been created by considering mother's education (illiterate, literate) and household wealth, a proxy of household economic status (Not rich, Rich). The joint influence of education and household wealth has a significant impact on the occurrence of the childhood diarrheal disease in Bangladesh. This study

enlightened the impact of this education-wealth composition variable. According to some previous literatures, socio-economic factors plays a vital role in the occurrence of communicable diseases like childhood diarrhea through their indirect link with the quality of life, healthcare facilities and behavioral awareness relating to disease prevention (Rahman, 2006; Dessalegn et al., 2011; Green et al., 2009; Mohammed et al., 2013).

The BDHS 2017-18 reports contains a lack of evidence in demonstrating the factors which affect the occurrence of childhood diarrhea. According to the report the prevalence of diarrhea could only determine by children age and division. In this study our objective is to find out the impact of other factor that is significantly contributing to this disease (NIPORT, 2020). This study is aimed to determine the role of exposure variable (education-wealth composition) on the probability of occurring childhood diarrhea by contributing socio-economic and demographic factors (Woldu et al., 2016). To examine quantitative impact of main exposure variable on the incidence of diarrhea disease, a statistical model is used in order to get a suitable conclusion for the childhood diarrhea.

SUBJECTS AND METHOD

1. Study Design

The current study was utilized the dataset from Bangladesh Demography and Health Survey (BDHS) 2017 which is well known as a national demographic and health survey. It provides information on demographic status, family planning, maternal health and health and nutritional status of children. The dataset was collected following a two-stage stratified sampling of household. In the first stage, 672 EAs were selected with probability proportional to the size of EA. Among the EA 250 EAs were

in urban areas and 425 in rural areas. On the second stage an average of 30 households per EA was selected by a systematic sampling procedure in order to provide statistically accurate estimates of socio-economic, demographic and health related variables.

2. Population and Sample

According to this survey design, 20,250 residential households were selected and completed interviews with an expectation of approximately 20,100 married women between the ages of 15 and 49 years. In the dataset some of the mothers and household level variables were included. Finally, we had considered 7410 children after adjusting for missing value.

3. Study Variables

All the categories of the categorical variables have been presented in the parenthesis. In this study, the outcome variable of interest was "whether a child had experienced diarrheal diseases in the two weeks preceding the survey (yes, no)".Therefore, the outcome variable of interest was binary in nature. Some covariates were considered as predictor variables for the analysis. A new variable depicting the joint influence of mother's education (Illiterate, Literate) and household wealth (Rich, Not rich) on the outcome event had been considered as the exposure variable of interest. This variable was named as education-wealth composition (illiterate-not rich, illiterate-rich, literate-not rich, and literate-rich).Based on some previous literatures, we had considered a set of explanatory predictor variables such as Age of children (<6 months, 6-23 months, 24-35 months, ≥36 months), Delivery by caesarean section (No, Yes), Migration status (Temporary (1-4 years), >5 years, Permanent residence), Mother's age at birth (<20 years, 20-29 years, >30 years), Type of residence (Urban, Rural), Source of toilet facility (Unimproved,

Improved), Sources of drinking water (Unimproved, Improved) in this study.

4. Operational Definition of Variables

Education-wealth composition demonstrated the joint influence of mother's education and household wealth status. It explored the role of mother's education among the respondents of different household economic status. Thus the variable mother's education have been categorized into two categories where the first category includes the mothers who didn't have any kind of formal education and the other category imputes the mothers who had attended at least one educational institute. Wealth index was created by using the rank wealth index factor score and then divide the ranking into two categories. First category comprised 66.67% of the sample household.

Age of children (months) at the time of survey was categorized into three categories such as less than 6 months, 6-23 months, 24-35 months and greater than 36 months.

Migration status was created using the variable "years lived in place of current residence". Temporary migrant was defined if "year live in place of residence" was between 1-4 year, respondents who were living always in the current place of residence are treated as permanent resident.

Mothers age at birth (years) at the time of survey was categorized into three categories like less than 20 years, 20-29 years and 30+ years.

Type of water facility was a level of measurement of water contamination and was recorded into two categories (improved, unimproved) on the basis of it is purity. Improved sources of drinking water imputed piped water, public taps, standpipes, tube wells, boreholes, protected dug wells and springs, rainwater, water delivered via a tanker truck or a cart with a small tank, and bottled water.

Type of toilet facility was measured by considering the advanced facility of sanitation and on the basis of this it was categorized into two categories (Improve, Unimproved). Improved sources of toilet facilities included flush/pour flush toilets that flush water and waste to a piped sewer system, septic tank, pit latrine, or unknown destination; ventilated improved pit (VIP) latrines; pit latrines with slabs; or composting toilets.

5. Study Instruments

The data was collected from a secondary data source named Bangladesh Demographic and Health Survey 2017-18 (BDHS-2017). The BDHS 2017 dataset was collected by using six different kind of questionnaire. Among them the Women's questionnaire covered ever-married reproductive women aged 15-49. It is based on the model based questionnaire which was developed for the DHS-7 program. The content of the instruments applied into the prior BDHS 2017 survey was used for lighting up the situations and need in the Bangladesh.

6. Data Analysis

In this study both bivariate and multivariate analysis had been conducted to analyze the data. Firstly a bivariate analysis was conducted by using chi square test for each explanatory variable. The multivariate analysis was carried out by using binary logistic regression model. The statistical software package STATA version 13.0 and SPSS version 20 were used to extract the analytical information from BDHS 2017 dataset. SPSS 20 was used in order to obtain the percent distribution from the bivariate table. To find the influential factors and their consequences on the occurrence of diarrhea disease among the children, a binary logistic regression model had been employed. In logistic regression, a mathematical model of a set of explanatory

variables was used to predict a log odds of occurring the outcome event.

7. Research Ethics

This study was conducted by using a nationally representative secondary data. Ethical approval had been obtained from the Measure DHS by taking authorized permission to use Bangladesh Demography and Health Survey 2017-2018.

RESULTS

1. Univariate Analysis

The univariate analysis had been conducted to explore the individual frequency percentage of the correlates which were included in this study. It demonstrated the percentage of respondents in each category of the required variables.

Table 1 demonstrated the socio-demographic characteristics of the respondents. According to this study in the variable education-wealth composition, the highest amount of respondents with the percentage of 59.73% was from literate and not rich category. Most of the children (41.28%) of this study were aged greater than 36 months at the time of survey. In Bangladesh delivery by caesarean section were most demanding (80.63%). Major percentage of respondents had been migrated within 5 years (58.48%). Mothers were mostly aged between 20-29 years (56.28%). Teenage mothers (27.94%) were second highest in percentage. In this study rural counterparts were the highest (64.60%) then the urban (35.40%). The highest number of respondents (68.14%) was experiencing an amending quality of toilet facility. Similarly 98.04% respondents enjoy pure water supply while 1.96% was used contaminated water.

Table 1. Descriptive analysis and Chi-square test of occurrence of diarrheal disease among the under five children of background characteristics

Variable	Category	N	%
Education-wealth composition	Illiterate & not rich	495	6.68
	Illiterate & rich	78	1.1
	Literate & not rich	4426	59.7
	Literate & rich	2411	32.5
Age of children	<6 months	725	9.8
	6-23 months	2153	29.1
	24-35 months	1473	19.9
	≥36 months	3059	41.3
Delivery by caesarean section	No	5975	80.6
	Yes	1435	19.4
Migration status	Temporary (1-4) years	2179	29.4
	>5 years	4333	58.5
	Permanent residence	898	12.1
Mother's age at birth	<20 years	2070	27.9
	20-29 years	4170	56.3
	>30 years	1170	15.8
Type of residence	Urban	2623	35.4
	Rural	4787	64.6
Source of drinking water	Unimproved	145	1.9
	Improved	7265	98.0
Types of toilet facility	Unimproved	2361	31.9
	Improved	5049	68.1

2. Bivariate Analysis

In the bivariate analysis (Table 2), chi-square statistic is used to reveal the expo-

sure factors and it is significant influence on the distribution of under five children having diarrhea disease.

Table 2. Descriptive analysis and Chi-square test of occurrence of diarrhea disease among the under five children of background characteristics

Variable	Diarrhea				OR	p
	Yes		No			
	n	%	n	%		
Education-wealth composition						
Illiterate & not rich	31	6.3	464	93.7	3.96	0.266
Illiterate & rich	1	1.3	77	98.7		
Literate & not rich	227	5.1	4199	94.9		
Literate & rich	118	4.9	2293	95.1		
Age of children						
<6 months	22	3.0	703	96.9	158.59	<0.001
6-23 months	211	9.8	1942	90.2		
24-35 months	77	5.2	1396	94.8		
≥36 months	67	2.2	2992	97.8		
Delivery by caesarean section						
No	267	4.5	5708	95.5	24.49	<0.001
Yes	110	7.7	1325	92.3		
Migration status						
Temporary (1-4) years	142	6.5	2037	93.5	13.13	<0.001
≥5 years	193	4.5	4140	95.6		
Permanent residence	42	4.7	856	95.3		
Mother's age at birth						
<20 years	108	5.2	1962	94.8	5.86	0.053
20-29 years	226	5.4	3944	94.6		
≥30 years	43	3.7	1127	96.3		
Type of residence						
Urban	135	5.1	2488	94.8	0.03	0.864
Rural	242	5.1	4545	94.9		
Source of drinking water						
Unimproved	4	2.8	141	97.2	1.66	0.197
Improved	373	5.1	6892	94.9		
Types of toilet facility						
Unimproved	121	5.1	2240	94.9	0.01	0.921
Improved	256	5.1	4793	94.9		

The bivariate association of the data by using chi-square statistic revealed that the socioeconomic and demographic factors significantly influence the distribution of under five children diarrhea disease. Among the socioeconomic and demographic variables age of children, delivery by caesarean section and migration status had significant association with the occurrence of diarrhea. Mothers who faced a caesarean delivery had the highest percentage (7.67%) of diarrhea occurrence among their children (p<0.001). Children aged between 6-23 months (9.8%) were highly affected by diarrhea, whereas they were least (2.19%) affected if their age exceeds 35 months (p-value<0.001). Moreover, the percentage of having diarrhea was the highest (6.52%) among the temporary residence (1-4 years) and lowest (4.45%) among the respondents who had been lived in the place for more than 5 years (p= 0.001).

The variable mother's age at birth was marginally significant (p= 0.053). The percentage of children with diarrhea was high (5.42%) among the mothers aged between 20-29 years and low (3.68%) among them others aged more than 30 years (p= 0.053). Therefore the age of children and mother at birth, delivery pattern and movement status of parents had significant influence on the distribution of under-five diarrhea diseases. Insignificant variables obtained from the bivariate analysis were also included in the final multivariate analysis.

3. Multivariate Analysis

Table 3 reported the effects of socioeconomic and demographic covariates on underfive children having diarrhea by using the binary logistic regression model.

Table 3. Effects of socioeconomic and demographic covariates on underfive children having diarrhea by using the binary logistic regression model

Independent Variable	OR	95% CI		p
		Lower Limit	Upper Limit	
Education- wealth composition				
Illiterate &Notrich	1			
Illiterate & Rich	0.17	0.02	1.30	0.088
Literate &Notrich	0.64	0.43	0.96	0.030
Literate & Rich	0.55	0.35	0.88	0.012
Age of Children				
<6 months	1			
6-23 months	3.49	2.23	5.48	0.001
24-35 months	1.75	1.08	2.85	0.023
≥36 months	0.77	0.47	1.26	0.295
Delivery by caesarean section				
No	1			
Yes	1.14	0.88	1.47	0.316
Migration status				
Temporary (1-4) years	1			
>5 years	0.86	0.67	1.12	0.260
Permanent residence	0.84	0.58	1.21	0.343
Mother's age at birth				
<20 years	1			
20-29 years	1.07	0.82	1.39	0.615
>30 years	0.69	0.46	1.02	0.065
Type of residence				
Urban	1			
Rural	0.92	0.72	1.17	0.486
Source of drinking water				
Unimproved	1			
Improved	2.02	0.74	5.53	0.173
Types of toilet facility				
Unimproved	1			
Improved	1.05	0.82	1.35	0.716
Constant	0.03	0.01	0.09	<0.001
N observation= 8759				
-2 log likelihood= -1403.62				
Nagelkerke R²= 7%				

The odds of occurring diarrheal diseases among under five children for selected socioeconomic and demographic characteristics were investigated by binary logistic regression model. The results of binary logistic regression model were

presented in table 2. children aged between 6-23 months (OR= 3.50; 95% CI= 2.23 to 5.48; p<0.001) and 24-35 months (OR= 1.75; 95% CI= 1.08 to 2.85; p= 0.023) had higher risk of getting affected by diarrhea than the newborn babies (age <6 months), whereas older children (more than 3 years) (OR= 0.77; 95% CI= 0.47 to 1.26; p= 0.295) had lower the risk of getting affected by diarrhea. The joint composition of respondent's wealth status and educational achievement played a significant role in the occurrence of under-five diarrhea. Although women who were literate and their wealth status was not rich had lower risk (OR= 0.64; 95% CI= 0.43 to 0.96; p= 0.030) for their children to get affected by diarrhea than the women who were illiterate and wealth was not rich. Besides women who were literate and rich have the lowest risk (OR= 0.55; 95% CI= 0.35 to 0.88; p= 0.012) comparing to the reference category.

DISCUSSION

Some key factors are working behind the fluctuation of the aptitude of occurring diarrhea. The findings of some previous studies emphasize that various socioeconomic and demographic factors are responsible for the increasing higher risk for childhood diarrhea which includes some cross-sectional studies of Ethiopia, Zimbabwe, Uganda, India and a case control study which was done in Lesotho (Bbaale, 2011; Dessalegn et al., 2011; El-Gilany & Hammad, 2005; Daniels et al., 1990; Avachat et al., 2011). Most of the studies found that two main environmental factors such as water facility and toilet facility are significantly impactful in the occurrence of diarrheal diseases (Avachat et al., 2011; Peace, 2018; Mihrete et al., 2014; Dessalegn et al., 2011). According to some previous studies other socio and demographic factors like socioeconomic status, educational status,

child age, mother's occupation are significantly associated with childhood diarrhea (Mihrete et al., 2014; Dessalegn et al., 2011; Peace, 2018).

This current research study demonstrated that environmental factors are no longer associated with this phenomenon. Although it is a good indicator, in Bangladesh diarrheal diseases still exists and the rate of prevalence of childhood diarrhea is about 5% (NIPORT, 2020). In this study among the socioeconomic and demographic factors child age is found to be a significantly important factor in diarrheal occurrence. Children aged greater than 6 months carry a higher risk of getting affected by diarrhea while children aged more than 3 years outgrow form its impact. Some previous literatures strongly support this statement (Mihrete et al., 2014; Mølbak et al., 1997; Siziya et al., 2009). It is found that mothers educational and socioeconomic status have significant association with the occurrence of childhood diarrhea in some literature (Mihrete et al., 2014; Levine & Levine, 1991; Yohannes et al., 1992; Kumar & Das, 2014; Checkley et al., 2002). According to the BDHS 2017-2018 report, some important socio-demographic factors such that child's sex, source of drinking water, type of toilet facility, place of residence, mother's education and household wealth are insignificant for the occurrence of diarrhea disease (NIPORT, 2020).

Despite of this scenario this study finds that joint impact of education and wealth index such as education-wealth composition variable played an important role in explaining the occurrence of childhood diarrhea. Interestingly education-wealth composition variable found to be significant in multivariate while it was insignificant in bivariate analysis. One of the possible reasons is that education-wealth composition can influence the

occurrence of diarrheal disease jointly with the other covariates that had been taken into this study. Hosmer and Lemeshow R^2 is a measure of how much the badness of fit improves as a result of the inclusion of the predictor variable. In our fitted model the value of Hosmer and Lemeshow R^2 is 0.94. That means the inclusion of covariates of this model results in 94% reduction in the log likelihood than the model contains intercept only.

Although the standard of life has improved to some extent in Bangladesh the importance of some socioeconomic and demographic factors has lagged noticeably behind. The findings of this study have implications for public health programs seeking to control morbidity among the under five children in developing country like Bangladesh. This study strongly recommended that the mother of a child must be adequately educated or informed about the essentiality of using good hygiene practices. The policy maker need to explore the mechanism that how the education-wealth composition affects the childhood diarrhea. Some comprehensive studies are needed to be conducted for better understanding about the mechanism. These initiatives will strengthen the public awareness in order to eradicate the incidence of diarrhea forever.

AUTHOR CONTRIBUTION

Sharlene Alauddin: Statistical analysis, designing and drafting of the original manuscript, M. Ershadul Haque: Statistical analysis, Review of the manuscript to the scientific and intellectual input.

CONFLICT OF INTEREST

There were no conflicts of interest.

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