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DETERMINANTS OF NUTRITIONAL STATUS OF UNDER FIVE CHILDREN IN BANGLADESH: A MULTIVARIATE REGRESSION ANALYSIS

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Abstract

The key measures of child under-nutrition namely, stunting, wasting and underweight are sometimes inter-related and hence may mislead if univariate approach of analyzing the data is performed. This paper employed multivariate logistic regression model for identifying the most significant determinants of the three standard child under-nutrition measures using Bangladesh Demographic and Health Survey (BDHS, 2011) data. The analysis identified educational attainment of mother, wealth index, size of child at birth, and preceding birth interval as most responsible determinants of nutritional status of under-five children. Furthermore, this research revealed that a child may suffer from one or more form of under-nutrition and hence recommended different policy options. Overall, the findings of this report are expected to feed the policy decisions regarding child nutrition in an integrated and holistic manner.

Keywords: Malnutrition, BDHS, under-five children, multivariate regression.

Introduction

The nature and determinants of maternal and child under nutrition in a conceptual framework has been outlined more than two decades ago to enhance the effectiveness of nutrition-specific interventions. Hence child under-nutrition is caused not just by the lack of adequate, nutritious food, but by frequent illness, poor care practices and lack of access to health and other social services. This conceptual framework is as relevant today as it was then, but it is now influenced by recent shifts and exciting developments in the field of nutrition. The UNICEF (2013) conceptual framework defines that nutritional status is influenced by three broad factors: food, health and care. Child under nutrition is assessed by measuring height and weight and screening for clinical manifestations and biochemical markers. Indicators based on weight, height and age are compared to international standards and are most commonly used to assess the nutritional status of a population. Three standard indices of physical growth that describe the nutritional status of children are: Height-for-age (stunting), Weight-for-height (wasting) and Weight-for-age (underweight). Stunting reflects chronic under nutrition during the most critical periods of growth and development in early life. It is defined as the percentage of children aged 0 to 59 months whose height for age is below minus two standard deviations (moderate and severe stunting) and minus three standard deviations (severe stunting) from the median of the WHO Child Growth Standards. Wasting reflects acute under nutrition which considers weight for height while underweight is a composite form of under nutrition that includes elements of stunting and wasting and considers weight for age. The categorization is the same as stunting (UNICEF, 2013).

Malnutrition among under-five children is a chronic problem in developing countries like Bangladesh. An estimated one third of deaths among children under age 5 are attributed to under nutrition. Globally, more than one quarter (26%) of children under 5 years of age were stunted in 2011– roughly 165 million children worldwide (UNICEF, 2012). But this burden is not evenly distributed around the world. Sub-Saharan Africa and South Asia are home to three fourths of the world's stunted children. In Sub-Saharan Africa, 40 % of children under 5 years of age are stunted; in South Asia, 39 % are stunted. Moreover, in 2011, an estimated 101 million children under five years of age were underweight, or approximately 16 % of children under five whereas the prevalence is highest in South Asia. In 2011, more than 20 million infants, an estimated 15 % globally, were born with low birth weight. India alone accounts for one third of the global burden. South Asia has by far the greatest regional incidence of low birth weight, with one in four newborns weighing less than 2,500 grams at birth (UNICEF, 2012). Bangladesh is a developing country experiencing an alarming level of child nutritional deficiency and poor nutritional status is a key

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health problem here. According to BDHS (2011) 41 % of children under age five are stunted, 16 % are wasted, and 36 % are underweight (BDHS, 2011). Although problems related to poor nutrition affect the entire population, women and children are especially vulnerable because of their unique physiology and socioeconomic characteristics.

A number of studies have been conducted on nutrition status in the context of Bangladesh, but most of them either did not analyze data using multivariate approach (Alom *et al.*, 2012). In addition, many studies have shown bivariate analysis to assess the determinants of under nutrition among under two year old children of rural Bangladesh (Ahmed, 2012). Rayhan and Khan (2006) investigated the impact of some demographic, socioeconomic, environmental and health-related factors on child nutritional status using the nationwide data of the Bangladesh Demographic and Health Survey (BDHS, 1999–2000). They observed that previous birth interval, size at birth and mother's education had a significant influence on chronic malnutrition. Size at birth and mother's nutritional status had a significant influence on both wasting and underweight. A strong and significant association between household wealth inequality and chronic childhood under nutrition in Bangladesh was identified in a study by Hong *et al*. (2006) using data from the BDHS (2004). Furthermore, the study revealed that children from the poorest households had a higher risk of being chronically malnourished than those of wealthiest households.

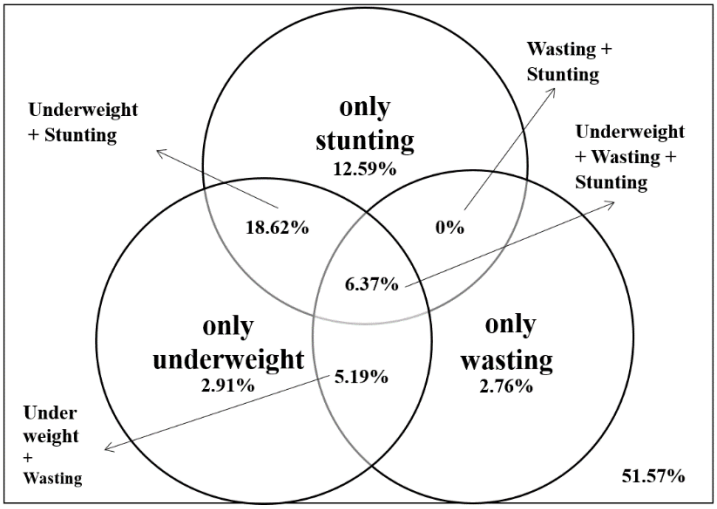

Fig. 1. Percentage distribution of three key factors in nutritional status.

As the nutritional status like stunting, wasting and underweight are influenced by the determinants altogether, sometimes considering the single (multiple regression) model will not be worth attempting. Also, malnutrition situation in Bangladesh is such that there is likelihood that a single child may fall under one or more types of malnutrition. The Fig. 1 shows the percentage of under-five children at different combination of health status.

Around 48.43 % children have at least one lack of proper growth and body composition that can be used to assess the nutritional level. Among them 6.37 % children share all kinds of nutritional severity. So it is very much important to find out the determinants considering these key factor altogether. The main objective of the study is to identify the most important factors that contribute to under five child nutrition in Bangladesh using multivariate regression approach. Since good nutrition is a prerequisite for the national development of countries and for the well-being of individuals, this study may provide right conditions and framework at policy and regulatory level in Bangladesh.

Materials and Methods

Data: This study used the data from Bangladesh Demographic and Health Survey (2011). The BDHS (2011) is a nationally representative survey designed to provide information on basic national indicators of social progress including fertility, childhood mortality, contraceptive knowledge and use, maternal and child health, nutritional status, awareness of AIDS and domestic violence. The BDHS (2011) was conducted on a two-stage stratified sample of households where each of the seven administrative divisions of Bangladesh (Barisal, Chittagong, Dhaka, Khulna, Rajshahi, Rangpur and Sylhet) is divided into a number of clusters. A total of 10,996 ever-married women of age 15

– 49 from the selected households were interviewed to collect data on fertility, family planning, child and maternal health.

Methods: Multivariate logistic regression is used when the data composed of several interrelated categorical dependent variables together with categorical or continuous independent variables.

Let Y_i be the vector of n measurements for the i^{th} dependent variable: $Y_i = (Y_{i1}Y_{i2} \ldots Y_{in})'$

The general multivariate model assumes that Y_i satisfies a regression model

$$Y_i = X_i\beta + \varepsilon_i$$

with
X_i: matrix of covariates
β: vector of regression parameters
ε_i: vector of error components, $\varepsilon_i \sim N(0, \sum)$

We have the following distribution for Y_i : $Y_i \sim N(X_i\beta, \sum)$

The mean structure $X_i\beta$ is modelled as in classical linear regression and usually $\sum$ is just a general $(n \times n)$ covariance matrix (Diggle, 2002).

In such a situation, it can be used to define a class of logistic regression model.

The multivariate logistic regression model is: $\eta = X\ \beta$

Where, X is a $K \times P$ matrix of covariates and β is a P- dimensional vector of unknown parameters.

Again, η_1 is always 0. Let us consider, $Y_{ij} = M\ (\eta_i, \pi_i)$; Where, $C^T \log(L\pi_i) = X_i\beta$

The log likelihood function is: $L(\beta_i, Y_i) = Y_i^T log\pi_i$

β can be constructed by using the Fisher's scoring algorithm, where score vector is-

$$\delta(\beta_i, Y_i) = \frac{\delta\pi^T}{\delta\beta}\ diag({\pi_i}^{-1})Y_i$$

And the information matrix is- $\varphi_i(\beta) = \eta_i(\frac{\delta\pi}{\delta\beta})^T diag\ (\pi_i)^{-1}(\frac{\delta\pi}{\delta\beta})$.

Results and Discussion

Our analysis is based on data from the Women's Survey component of the BDHS (2011) reported on children born in the five years before survey date. The survey gives complete information for children with regard to their health, parental, household and community characteristics. In this study, a total of 8,271 women having children under five years of age were included. For explanatory variables, it deals with the distribution of the study population by different socio-economic, demographic, socio-cultural and biological characteristics. The results of multivariate regression analysis are summarized in the following Table 1. The response vector consists of stunting, wasting and underweight (1 = yes, 0 = no). The significance of coefficient values of the model along with the significant F-values and their R^2 values reveal the perfectness of fitting the model to the data.

Table 1. Multivariate regression model for identifying the significant effect of determinants on stunting, wasting and underweight.

Explanatory variables	Dependent variables		
	Stunting	**Wasting**	**Underweight**
Intercept	0.356***	1.46***	0.434***
Region (*Ref*: Sylhet)			
Barisal	-0.042	-0.03	-0.05**
Chittagong	-0.033	-0.018	-0.049***
Dhaka	-0.006	-0.014	-0.045**
Khulna	-0.06***	-0.022	-0.087***
Rajshahi	-.109***	-0.01	-0.093***
Rangpur	-0.43**	-0.037**	-0.086***
Type of Place of Residence (*Ref*: Rural)			
Urban	0.022	0.001	-0.002
Religion (*Ref*: Islam)			
Others	0.034	0.026	0.034
Highest Educational Level (*Ref*: Higher)			
No Education	0.172***	0.031	0.153***
Primary	0.152***	0.10**	0.131***
Secondary	0.098***	0..041	0.067***
Sex of Child (*Ref*: Male)			
Female	-0.005	0.011	-0.022**
Wealth (*Ref*: Poor)			
Middle	0.161***	0.026**	0.154***
Rich	0.096***	0.041***	0.11***
Twin (*Ref*: Single Birth)			
Multiple Births	-1.36***	0.023	-.132***
Size of Child (*Ref*: Average)			
Large	-0.134***	-.121***	-.215***
Small	-0.08***	-0.9***	-1.44***
Preceding Birth Interval (*Ref*: Less than 3 years)			
First Birth	0.02	0.002	0.004
More than 3 years	0.085***	-0.006	0.038***
R^2	0.65	0.59	0.79
F- value	1.064**	1.015**	1.004**

Note: Significance ** p<0.05, *** p<0.01; *Ref* refers to reference category.

The R^2 values (0.65, 0.59 and 0.79) imply that 65 %, 59 % and 79 % of the total variation in nutritional status could be due to the discrepancy in all of those socio-demographic characteristics controlled for in the model. For this analysis, Sylhet was considered the reference area. Children from Khulna, Rajshahi and Rangpur compared to Sylhet were less likely to be stunted, whereas only Rangpur, and all the divisions were significantly less likely to be wasted and underweight, respectively than the children from Sylhet. This result is somewhat similar to the study by Alom *et al*. (2012). However, the reasons for slight deviation may be the restructuring of divisions and change over time. A significant monotonous increase in stunted, wasting and underweight were observed for primary educational attainment. On average, if the mother is educated at primary level they are 16 %, 10.5 % and 14 %, respectively more likely to have stunted, wasted and underweight children compared to mother having higher education, keeping all other variables constant.

Interestingly, poor mothers were less likely to have malnourished children while mothers having child other than average were more likely to have malnourished children. This confronts with the findings by Alom *et al*. (2012). Moreover, mothers having children with average size at birth would possibly suffer from these three key indicators of nutrition than those of large and small size children. For the variable, preceding birth interval we got that having birth interval more than 3 years, children were less likely to be malnourished. The findings in most of the cases conforms to similar study in the subcontinent (Rajaretnam and Hallad, 2000; Rayhan and Khan, 2006). Like other

studies (Omigbodun *et al.,* 2010) our study revealed that male children were more likely to be underweight than female children.

The results of this study showed that wide ranges of significant factors were present for the different nutritional categories at different locations of Bangladesh. Most of the predictor were influencing stunting and underweight in a similar fashion. Educational attainment of mother, socio-economic status like wealth index and the biological factors such as size of child at birth and preceding birth interval were highly significant factors to describe the nutritional status in Bangladesh altogether. Further research is needed to investigate why children of poor mothers and of average size are more likely to suffer from malnutrition compared to others. Our initial guess is that these are related to intensity of breast feeding among poor mothers and relatively less care for average children. The findings of this research using multivariate approach provide better insight about the likely predictors of malnutrition compared to multiple regression practices done earlier. It is expected that policy based on these will be more effective to combat malnutrition in Bangladesh.

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