GREEN PUBLICATION

International Journal For Research In Mathematics And Statistics

ISSN: 2208-2662

Volume 07 Issue 01 January 2021

Available on-line at https://ijfrms.com/index.php/ms/issue/archive

DOI:https://doi.org/10.53555/ms.v7i1.1474 Received: 06-Dec-2020 Accepted: 11-Jan-2021

Maternal socioeconomic, demographic and nutritional factors contributing to improve low birth size in Bangladesh

Tazia Hossain

Lecturer Department of Business Administration, Notre Dame University Bangladesh

E mail: tazia@ndub.edu.bd

Abstract

Though the child and infant mortality is decreasing for the last few decades, levels of infant and child mortality and morbidity in many developing countries including Bangladesh is still unacceptably high. Low birth weight is a significant indicator to premature birth,neonatal and infant mortality and associated with child development. The objective of thestudy is to evaluate impact of maternal socio-economic, demographic and nutritional (irontablets) factors on the low birth size. For the analysis of birth size status of child, binarylogistic regression model is applied. Number of antenatal visit during pregnancy, wealthindex, birth order, and child is twin and mother's education found significant for birth sizestatus. . This study recommend that selectively targeted interventions such as antenatalvisit (at least 3 visit during pregnancy), delay age at first pregnancy (at >20 year of age),improving maternal education and nutrition, iron and vitamin supplementation canprevent low birth size in Bangladesh. Sex of child, preceding birth intervals and religion areobserved insignificant but consistent with the expectation to reduce low birth size. Thisstudy suggests the strategy to reduce low birth size by increasing antenatal visits duringpregnancy and focusing on nutrition education, taking iron & vitamins supplementationduring pregnancy along with discouraging teenage pregnancy.

Key words: Low Birth Size(LBS), Antenatal Care (ANC), Binary Logistic Regression model.

I. Introduction

According to Bangladesh Demographic Health Survey Data, under-5 mortality rate has declined gradually over the last 2 decades, the decline has slowed noticeably between the 2014 BDHS and the 2017-18 BDHS. The infant and neonatal mortality have become stable during this period. The neonatal mortality rate is 30 deaths per 1,000 live births, i.e, it is responsible for 67% of all under-5 deaths.According to BDHS 2017, under-5 mortality in the 5 years preceding 2017 is 45 deaths per 1,000 live births, infant mortality rate is 38 deaths per 1,000 live births, and the child mortality rate is 7 deaths per 1,000 children.

A large number of mortality and morbidity can be prevented by identifying the factors associated with low birth size. The main objective of this study was to identify associated risk factors of low birth size.

According to, World Health Organization (WHO), low birth weight infants are 20 times more likely to develop complications and die in comparison to normal weight babies and low birth weight babies are at a higher risk of death and illness shortly after birth and non-communicable disease in the life course. According to WHO, low birth weight (LBW) as the birth weight less than 2500 grams irrespective of gestational age. Low birth weight is a important determinant of maternal health, nutrition, healthcare delivery, and poverty.

There are some other factors such as antenatal visits during pregnancy period, iron intake, Socioeconomic Variables(mother's education, religion, wealth index, religion), demographic variable(mother's age at birth, preceding birth interval, birth order and child is twin have effect on low birth size.

This study suggests that these interplaying factors are playing significant rules in reducing low birth size in Bangladesh.

II. Literature Review

Antenatal care (ANC) attendance is the starting point for seeking care during pregnancy and childbirth. A positive association of inadequate prenatal care and small birth size has been verified by Coria-Soto et al. (1996). ANC visits are found to be major defending factors

against LBW [Dharmalingam A. et al(2010)]. Antenatal care establishes the central medium through which socioeconomic status and women's reproductive behavior operate to influence size of a baby at birth (Greenberg 1983, Magadi et al. 2004). It may mean that it is quality of antenatal care has independently impact on the size of a baby.Some previous studies show that significant relationship between LBW and poor educational status [MATIN A et al (2008)]. Twins are more likely to be born with low birth weight and biological immaturity.

Poor nutrient intake, inadequate self-care including poor rest and a heavy work burden during pregnancy can indicate inadequate nutrient supply for placental and foetal growth that causes to LBW [Villar J. et al (2001), Hueston WJ et al(2003)]. Based on the health worker's assessment during pregnancy, pregnant woman are advised to receive additional nutritional supplements or advice for increased intake of multi-vitamins and protein supplements.

III. Methods

Small size at birth as dependent variable and other explanatory variables of interest are first evaluated by using Chi-square test ($\chi 2$). The significant factors identified in the univariate analysis are used in multiple logistic regressions. Binary logistic regression model is applied to investigate the factor influencing the associated risk of small child size at birth.

Logistic Regression Model

Logistic regression analysis models the relationship between a dependent and one or more independent variables. The binary logistic regression and its statistical calculation, are quite different to ordinary linear regression. In ordinary linear regression, ordinary least square is used to find a best fitting line and estimates the coefficients that predict the change in the dependent variable for one unit change in the independent variable. The logistic regression estimates the probability of an event occurring, the probability (p) that it is 1 (event occurring) rather than 0 (event not occurring).

The Structure of Logistic Regression Models

Usually there are three components in logistic regression model,. These are:

1. **Random Component:**

The random variables y_i(i=12,…,n) has a probability distribution with mean μ_i and variances ${\epsilon_i}^2$.

2. **Systemic Component:**

A set of covariates $x_i(x_{i1,} \dots, x_{ij}, \dots, x_{ip})$ associated with scale $y_i$produces a linear predictor.

$\eta_i = x_i' \beta$.

Where β = $(\beta_1, \dots, \beta_j, \dots, \beta_p)$ is the regression coefficient vectors. Note that η_i is linear in β and - - $\infty < \eta_i < \infty$.

3. **Link Function:**

A function bridge between random component and systematics component as

$$g(\mu_i) = \eta_i.$$

Where the function $g(.)$ is the link function and it is monotone and differentiable function.

We consider there are n individuals, some of them are called “success” and the other are failure, where the response yi is binary, assuming only two values that for convenience this study is coded as one or zero, i.e,

$$y_i = \begin{cases} 1 \; if \; the \; ith \; individual \; is \; with \; low \; birth \\ 0 \; if \; the \; ith \; individual \; is \; normal \; in \; size. \end{cases}$$

The random variabley_i, can take the values one and zero with probabilities π_i and 1-π_i, respectively. The distribution of y_i is called a Bernoulli distribution with parametarπ_i, and can be written in compact form as

$Pr\{Y_i = y_i\} = {\pi_i}^{y_i}(1-\pi_i)^{(1-y_i)}$.

for y_i= 0,1; Note that if y_i=1 we obtainπ_i , and if y_i = 0 , we obtain 1-π_i. It is fairly easy to verify by direct calculation that the expected value and variance of $y_i$are

$E(Y_i) = \mu_i = \pi_i$.

$Var(Y_i) = {\epsilon_i}^2 = \pi_i(1-\pi_i)$.

In the logistic regression model, logit link function is used to make the bridge between mean of response μ_i and linear predictor, η_i as below

$$\ln\left[\frac{\mu_i}{1-\mu_i}\right] = \eta_i$$

$$= x_i'\beta \qquad \ldots (1)$$

Logic link is nothing but the natural log of odd of having $y_i = 1$.The model given in (1) is called the logit regression model.

It can be easily be shown from (1) that

$$\frac{\pi_i}{1-\pi_i} = e^{x_i'\beta}$$

$$\text{Or, } 1 + \frac{\pi_i}{1-\pi_i} = 1 + e^{x_i'\beta}$$

$$\text{Or, } \frac{1}{1-\pi_i} = 1 + e^{x_i'\beta}$$

$$\text{Or, } 1 - \pi_i = \frac{1}{1 + e^{x_i'\beta}}$$

$$\text{Or, } \pi_i = \frac{e^{x_i'\beta}}{1 + e^{x_i'\beta}} \qquad \ldots (2)$$

The model in (2) is called the logistic regression.

Interpretation of Parameter Estimates

$exp(\beta_0)$ = the odds that the characteristic is absent in an observation i when = 0, i.e., at baseline.

$exp(\beta_1)$ = for every unit increase inx_{i1}, the odds that the characteristic is present is multiplied by $exp(\beta_1)$ this is similar to simple linear regression but instead of additive change it is a multiplicative change in rate. The estimate of odds ratio

$$\text{Odds Ratio} = \frac{\pi_i}{1-\pi_i}$$

In general, the logistic model stipulates that the effect of a covariate on the chance of "success" is linear on the log-odds scale, or multiplicative on the odds scale.

If $\beta_j > 0$, then $exp(\beta j) > 1$, and the odds increase.

If $\beta_j < 0$,then $exp(\beta j) < 1$, and the odds decrease.

IV. Data

DHS survey data 2014 which includes information on women who use modern as well as other (traditional) maternal health care which is more representative and are expected to identify better factors associated with small size at birth

Here, consider

Model 1: Antenatal variables alone

Model 2: Model 1 & maternal variables

Model 3: Socio-economic variables

Model 4: Demographic variables

Analysis is carried outin model 1, for number of antenatal visit during pregnancy.

Table 4.1: Odds ratio for small size at birth by antenatal

	Odds Ratio		95% C.I.for EXP(B)	
Variables	EXP(B)	p-value	Odds Ratio	p-value
Number of antenatal during pregnancy				
No antenatal visit(ref)	-	-	-	-
One antenatal visit	1.020	.859	.817	1.275
Two antenatal visit	.902	.399	.709	1.147
Three antenatal visit	.772	.040	.603	.988
Four & more antenatal visit	.775	.058	.596	1.008

Antenatal Visit during Pregnancy

The link between antenatal visit during pregnancy and size of baby at birth is statistically found significant for three antenatal visits in this study. There is a positive association

between ANT visits and low birth size i.e, when the antenatal visit numbers increased two to four the giving birth of small babies reduced.

Table 4.2: Odds ratio for small size at birth by antenatal care, maternal indicators

	Odds Ratio		95% C.I.for EXP(B)	
Variables	EXP(B)	p-value	Odds Ratio	p-value
Number of antenatal during pregnancy				
No antenatal visit(ref)	-	-	-	-
One antenatal visit	1.024	.833	.819	1.280
Two antenatal visit	.903	.405	.709	1.149
Three antenatal visit	.773	.041	.604	.989
Four & more antenatal visit	.778	.062	.598	1.013
Iron				
No (ref)	-	-	-	-
Yes	.973	.889	.663	1.428
Mother's age at birth				
Less than 20 years(ref)	-	-	-	-
20 to 30 years	.967	.866	.654	1.429
30 to 35 years	.781	.204	.534	1.144
More than 35 years	.814	.365	.522	1.271

Results

The link between antenatal visit during pregnancy and size of baby at birth is statistically found significant in this stud and the direction of the relation is consistent with expectations. When the antenatal visit numbers increased two to four the giving birth of small babies reduced.

Mother's taking iron pills, sprinkles or syrup is not statistically significant for the incidence of small size at birth. But the direction is consistent with expectations; the risk of small babies is reduced for taking iron pills, sprinkles or syrup compare to do not taking Iron.

Mother's age at birth is not statistically significant for the incidence of small size at birth. But are consistent with expectations; the risk of small babies is reduced for more than 20 years age compare to less than 20 years age.

Table4.3 Odds ratio for small size at birth by demographic indicators

Variables	Odds Ratio		95% C.I.for EXP(B)	
	EXP(B)	p-value	Lower	Upper
Mother's education				
No Education(ref)	-	-	-	-
Primary Education	2.195	.000	1.523	3.163
Secondary Education	1.648	.004	1.172	2.316
Higher Education	1.315	.091	.957	1.808
Religion				
Non-Muslim(ref)	-	-	-	-
Muslim	1.256	.111	.949	1.662
Wealth Index				
Poor(ref)	-	-	-	-
Middle	1.269	.033	1.020	1.580
Rich	1.266	.056	.994	1.612
Residence				
Rural(ref)	-	-	-	-
Urban	.951	.612	.783	1.155

Results

The relationship between maternal education and birth size is significant for primary and secondary education. In table 3, (the model 3), the odds of giving birth to small sized babies increased for primary, secondary and higher educated mothers compared to the mothers with no education.

Religion plays a very significant role on the incidence of small-sized babies and woman's access to health care in the Bangladesh. Muslims women categories increased the odds for small size at birth by 25.6% compared to non-muslims women. Muslim practice of 'purdah' (wife seclusion) restricts women's access to medical care (Wall 1998).

In table 3, comparing the wealth index, mother from middle households is significantly 26.9% increased odds of giving birth to small sized babies compared to from poor households. And in rich households is insignificantly 26.6% increased odds of giving birth to small sized babies compared to poor households.

However in the urban area is insignificantly 95.1% reduced odds of giving birth to small sized babies compared to rural area**.**

Table 4.4: Odds ratio for small size at birth by demographic indicators

	Odds Ratio		95% C.I.for EXP(B)	
Variables	EXP(B)	p-value	Odds Ratio	p-value
Preceding birth intervals				
Less than 24 months (ref)	-	-	-	-
24 & more than 24 months	1.000	.999	.709	1.409
Birth order				
1st birth(ref)	-	-	-	-
2nd or higher order	.816	.016	.692	.962

Child is twin				
Single birth(ref)	-	-	-	-
Multiple birth	5.35	.000	3.034	10.098
Sex of child				
Female(ref)	-	-	-	-
Male	.896	.181	.762	1.053

Results

Birth orders are statistically significant. Second or higher birth 81.6% reduced the odds of giving birth to small size child baby compare to first birth.

In case of twin child, multiple birth in pregnancy highly statistical significantly increased the odds of giving birth to small size child baby.

The preceding birth intervals and child are not statistically significant for the incidence of small size at birth.

V. Recommendation

Based on the findings the following recommendations are forwarded:

- Attendants of ANC should receive during pregnancy which may improve neonatal outcomes.
- Policy makers and health planers should optimize programs of community based nutritional promotion programs.

VI. Limitation

The successful usage of birth size as a proxy for birth weight (although a weakness of the study). All the analysis is carried out on size at birth information.

VII. Conclusion:

It is concluded from this study that teen-age pregnancy and poor antenatal care have strong association with low birth size. At least three antenatal visits during pregnancy,

mother of > 20year of age group, wealth index, birth order, and child in twin are found significant in low birth size. To overcome these problems, the mother and child related health services should be given special attention in Bangladesh. Iron & vitamin supplementation during pregnancy is found insignificantly but the direction is consistent with expectations; the risk of small babies is reduced for taking iron pills, sprinkles or syrup compare to do not taking iron pills.

Reference

1. Anjum, F., Javed, T., Afzal, M. F., & Sheikh, G. A. (2011). Maternal risk factors associated with low birth weight: A case control study. *Annals of King Edward Medical University*, *17*(3), 223-223.
2. Anjum, F., Javed, T., Afzal, M. F., & Sheikh, G. A. (2011). Maternal risk factors associated with low birth weight: A case control study. *Annals of King Edward Medical University*, *17*(3), 223-223.
3. Gebremedhin, M., Ambaw, F., Admassu, E., &Berhane, H. (2015). Maternal associated factors of low birth weight: a hospital based cross-sectional mixed study in Tigray, Northern Ethiopia. *BMC pregnancy and childbirth*, *15*(1), 222.
4. MonawarHosain, G. M., Chatterjee, N., Begum, A., &Saha, S. C. (2005). Factors associated with low birthweight in rural Bangladesh. *Journal of tropical pediatrics*, *52*(2), 87-91.
5. Anil, K. C., Basel, P. L., & Singh, S. (2020). Low birth weight and its associated risk factors: Health facility-based case-control study. *PloS one*, *15*(6), e0234907.
6. World Health Organization. (2004). *International statistical classification of diseases and related health problems: instruction manual* (Vol. 2). World Health Organization.
7. Wardlaw, T. M. (Ed.). (2004). *Low birthweight: country, regional and global estimates*. Unicef.

8. World Health Organization. (2014). *Global Nutrition Targets 2025: Low birth weight policy brief* (No. WHO/NMH/NHD/14.5). World Health Organization.
9. BangladeshDemographic and Health Survey, 2017–18.
10. BangladeshDemographic and Health Survey, 2014.
11. Magadi, M. A., Diamond, I., &Madise, N. (2000). *Individual and community level factors associated with premature births, size of baby at birth and caesarean section deliveries in Kenya* (No. 16). African Population & Health Research Center.
12. Bondevik, G. T., Lie, R. T., Ulstein, M., &Kvåle, G. (2001). Maternal hematological status and risk of low birth weight and preterm delivery in Nepal. *ActaobstetriciaetgynecologicaScandinavica*, *80*(5), 402-408.
13. Dharmalingam, A., Navaneetham, K., &Krishnakumar, C. S. (2010). Nutritional status of mothers and low birth weight in India. *Maternal and child health journal*, *14*(2), 290-298.
14. Chuku, S. N. (2008). Low birth weight in Nigeria: Does antenatal care matter. *Journal of Arts in Development Studies, Institute of Social Study Netherland*, *12*, 66-71.
15. Matin, A., Azimul, S. K., Matiur, A. K. M., Shamianaz, S., Shabnam, J. H., & Islam, T. (2008). Maternal socioeconomic and nutritional determinants of low birth weight in urban area of Bangladesh. *Journal of Dhaka Medical College*, *17*(2), 83-87.
16. World Health Organization. (2016). *WHO recommendations on antenatal care for a positive pregnancy experience*. World Health Organization.
17. Kominiarek, M. A., &Rajan, P. (2016). Nutrition recommendations in pregnancy and lactation. *Medical Clinics*, *100*(6), 1199-1215.
18. Caulfield, L. E., Witter, F. R., &Stoltzfus, R. J. (1996). Determinants of gestational weight gain outside the recommended ranges among black and white women. *Obstetrics & Gynecology*, *87*(5), 760-766.