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Prevalence and Associated Factors of Low Birth Weight in Bangladesh

Jannat Ara Nipa, Md. Sabiruzzaman, Abu Sayed Md. Al Mamun, Md. Nurul Islam, Md. Riptar Hossain, Md. Abdul Wadood and Md. Golam Hossain

Health Research Group, Department of Statistics, University of Rajshahi, Rajshahi-6205, Bangladesh.

*Correspondence should be addressed to Md. Golam Hossain (Email: hossain95@yahoo.com)

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Abstract

Birth weight (BW) has a long term impact on future health of a child. However, low birth weight (LBW) is a great public health concern in the world and it is an indicator of childhood mortality and morbidity especially in developing countries. The main objective of this study was to determine the prevalence and factors associated with LBW among Bangladeshi children. In this study secondary data were used, it was extracted from Bangladesh Health and Demographic Survey (BDHS), 2014. The data consisted of 4,494 married and currently non-pregnant Bangladeshi mothers who had at least one under five children living with their mothers considered sample in this study. Chi-square test and multiple logistic regression was used to find the associated factors of LBW of children. A total number of under-five children 4,494 were studied in the present study, and the study revealed that the overall prevalence of LBW among children in Bangladesh was 19.40%.The prevalence of LBW was found higher in rural area, among poor wealth quantile and in female child. Prevalence of LBW of children was the highest in Sylhet division and the lowest in Rajshahi division. Mothers, who were uneducated, undernourished, had no antenatal visit and used unhygienic toilet had greater chance to get LBW child. LBW is related to child mortality; however, factors of LBW were mostly modifiable. In order to reduce child mortality and to achieve SDGs by 2030, government should control the high prevalence of LBW in Bangladesh. Our findings would be useful for the health authorities of

Bangladesh for improving their health policy to lessen LBW children in Bangladesh.

Keywords: Bangladesh, Birth weight, Nutritional status, Antenatal care, Logistic regression.

AMS Classification: 62J05.

1. Introduction

Birth weight (BW) of children is an important indicator of their health. Low birth weight (LBW) increases the risk of death in the early months and years of a child's life, and those who survive tend to have impaired immune function and increased risk of infectious diseases. It was considered an important predictor for infant mortality, especially of deaths within the first months of life (Zenebe et al., 2014). LBW is an indicator of child's vulnerability to the risk of childhood illnesses and to predict the child's future health, development, and the chances of survival. Moreover, LBW is associated with poor neurological and cognitive development, childhood morbidity, growth impairment, a range of poor health outcomes, and chronic diseases later in life. It is a cause of both short-term and long-term consequences leading to adverse social and economic impacts (Sutan et al., 2014). It is highly linked with morbidity and mortality during neonatal period and later life. Globally, 60–80% of neonatal deaths occur among LBW infants (Sebayang et al., 2012). LBW babies are at higher risk of early growth retardation, infectious diseases and neuro-logical, neurosensory and developmental delays. Raqib et al. (2007) argue that LBW has an implication for immune competence and increased vulnerability to infectious diseases in later life. Borghese et al. (2015) claim that LBW was independently associated with the risk of endometriosis. The study of Tofail et al. (2012) reveals that in a poor-urban Bangladeshi community, LBW infants had significantly lower mental and psychomotor developments and were less active than normal birth weight (NBW) infants at 10 months of age.

There were greater than 20 million infants, representing 15.5% of all births, are born with LBW; 95.6% of them lived in developing countries, accounting for 17% of all births in developing countries (Bugssa et al., 2014 and Gebremedhin et al., 2015). The highest number of LBW children has been found in Asia and Africa regions while Oceania and Europe have the lowest rates (Neggers and Crowe,

2013). The prevalence of LBW children is 16% all over the world and 28% in South Asia, while it is 22%in Bangladesh (UNICEF, 2015).

Noting twin pregnancy of mothers, maternal weight and manual paternal employment as the risk factors for LBW, Dahlui et al. (2015) argue that these factors are mostly modifiable. Demelash et al. (2015) claim that women who were lived in rural area, faced health problems during current pregnancy, had no antenatal care during pregnancy had higher chance to give low birth weight babies. In developing countries, advanced maternal age, and inadequate antenatal visits have higher effects on LBW.

Reducing the prevalence of LBW can play a vital role in decreasing child mortality, which was one of the important concerns of the Millennium Development Goals (MDGs). Bangladesh, as one of the signatories of the MDGs, has achieved considerable progress in child mortality by 2014 (MDG, Bangladesh Progress Report, 2015). Also, LBW is highly related to child mortality, one of the important goals of SDGs is to reduce maternal and under five children morality rate, and Bangladesh Government is trying to achieve 17 goals under SDGs by 2030 (UNICEF, 2016). In Bangladesh, researchers have found a relationship between LBW children and maternal age, mother's nutrition, teenage pregnancy, poor antenatal care, mother's education (Khatun and Rahman, 2008; Klemnet al., 2013 and Karim et al., 2016).The present work will test the hypothesis and some modifiable factors such as education, place of residence, wealth index which can effect for getting the low birth weight child in Bangladesh.

2. Data and Method

Data source: The study design is transacted by cross-sectional dataset from the 2014 Bangladesh Demographic Health and Survey (BDHS-2014). The sampling techniques, survey design, survey instruments, measuring system and quality control have been described elsewhere (NIPORT, 2014).

Inclusion criteria: Only Bangladeshi women in reproductive age (15-49 years), non–pregnant women who had at least one child (under five) was considered as a sample in the present study which was taken from BDHS-2014 dataset.

Sample Selection Procedure: We extracted data from the present study from BDHS-2014, and considered only Bangladeshi mothers non-pregnant women who

had at least one child (under five) in the past three years of BDHS-2014 survey. The abnormal (outliers) value of data was checked by present authors using statistical techniques (Dunn & Clark, 1974), because abnormal value can able to effect the actual results come from data (Stevens, 1996). We also found some missing values, and these values were excluded. Then after removing pregnant women, mothers who did not give birth in the past three years of BDHS-2014 survey, and also excluded incomplete data, finally the data set was reduced to 4494 for the analysis in this study.

Outcome Variable: In this study, the outcome variable was considered as child birth weight. The proxy variable to measure child birth weight was classified into two classes such as (i) normal and (ii) low birth weight. The normal birth weight included very large, lager than average and average.

Independent Variables: Various socio-economic and demographic factors were used in this study as independent variables such as mother's occupation, father's occupation, parental education level, wealth index, residence, religion, toilet facilities, mother's age group, age at first cohabitation, total children ever to born, gender and nutritional status of mothers.

Statistical Analysis: Frequency distribution was used in this study to determine the prevalence of newborn care in Bangladesh. Chi-square test was used to find the significant association between two categories variables, and it was needed for selecting independent variables in multiple binary logistic regression models. We applied multiple binary logistic regression model to identify the effects of our selected socio-economic, demographic, anthropometric, health related and behavioral factors on newborn care in Bangladesh. SPSS (IBM, Version 23) software was utilized to analyze our data. A value of $p<0.05$ was considered as statistically significant in the analysis.

3. Results

Table 1 reports prevalence of low birth weight along with its association with sociodemographic variables. It was observed that 80.60 % of children in Bangladesh were born with normal weight and 19.40% of children were born with low birth weight. Among our samples, it was observed that prevalence of LBW varied significantly among seven divisions; the highest LBW was found in Sylhet division (26.8%) followed by Dhaka (22.0%), Chittagong (20.5%), Barisal

(16.4%), Rangpur (14.9%) and Rajshahi (14.1%) division respectively. Proportion of LBW also varied significantly due to residence. Higher percentage of LBW was found in rural area (20.5%) than that in urban (17.3%).

Variations in BW due to age of mother, occupation of father and mother, total number of children ever born and age of cohabitation were not statistically significant. On the other hand, significant variations in BW were found for education of father and mother, wealth index, attendance of qualified doctor, cost of delivery, received BCG, sex of child, toilet facilities, nutritional status, delivery place, and antenatal status. It was observed that the prevalence of LBW was showing decreasing tendency with increasing education level of father and mother, increasing wealth index and increasing nutritional status. Prevalence of LBW was lower if mother was attended by qualified doctor, received BCG, used hygienic toilet, had antenatal visit and if the delivery took place in hospital rather than home. It was also lower for male than female child (Table 1).

Table 1: Association between birth weight and sociodemographic factors

		Child birth weight		χ^2	p-value
	N (%)	Normal, N (%)	Low, N (%)		
Total	**4494**	**3620(80.6)**	**874(19.4)**		
Division					
Barisal	532(11.8)	445(83.6)	87(16.4)	49.13	0.0001
Chittagong	862(19.2)	685(79.5)	177(20.5)		
Dhaka	795(17.7)	620(78.0)	175(22.0)		
Khulna	531(11.8)	437(82.3)	94(17.7)		
Rajshahi	546(12.1)	469(85.9)	77(14.1)		
Rangpur	55(12.2)	468(85.1)	82(14.9)		
Sylhet	678(15.1)	496(73.2)	182(26.8)		
Residence					
Urban	1451(32.3)	1200(82.7)	251(17.3)	6.321	0.012
Rural	3043(67.7)	2420(79.5)	623(20.5)		
Sex of child					
Male	2321(51.6)	1903(82.0)	418(18.0)	6.342	0.012
Female	2173(48.4)	1717(79.0)	456(21.0)		
Child is alive					
No	124(2.8)	92(74.2)	32(25.8)	3.291	0.07
Yes	4370(97.2)	3528(80.7)	842(19.3)		
Delivery place					
Home	2693(59.9)	2128(79.0)	565(21.0)	10.07	0.002

Hospital	1801(40.1)	1492(82.8)	309(17.2)		
Mother education					
No education	607(13.5)	443(73.0)	164(27.0)	38.55	0.0001
Primary	1235(27.5)	977(79.1)	258(20.9)		
Secondary	2130(47.4)	1749(82.1)	381(17.9)		
Higher	522(11.6)	451(86.4)	71(13.6)		
Father education					
No education	1031(22.9)	776(75.3)	255(24.7)	37.06	0.0001
Primary	1353(30.1)	1073(79.3)	280(20.7)		
Secondary	1420(31.6)	1180(83.1)	240(16.9)		
Higher	690(15.4)	591(85.7)	99(14.3)		
Father occupation					
Agriculture	2170(48.3)	1727(79.6)	443(20.4)	4.647	0.098
Service & business	53(1.2)	39(73.6)	14(26.4)		
Worker	2271(50.5)	1854(81.6)	417(18.4)		
Mother occupation					
Non-housewife	1052(23.4)	843(80.1)	209(19.9)	0.154	0.695
Housewife	3442(76.6)	2777(80.7)	665(19.3)		
Religion					
Muslim	4134(92.0)	3334,(80.6)	800,(19.4)	0.306	0.58
Non-Muslim	360(8)	286,(79.4)	74,(20.6)		
Wealth index					
Poor	1795(39.9)	1393(77.6%)	402(22.4)	22.64	0.0001
Middle	860(19.1)	686(79.8)	174(20.2)		
Rich	1839(40.9)	1541(83.8)	298(16.2)		
Toilet facilities					
Hygienic	2754(61.3)	2277(82.7)	477(17.3)	20.56	0.0001
Unhygienic	1740(38.7)	1343(77.2)	397(22.8)		
Qualified doctor					
No	3061(68.1)	2416(78.9)	645(21.1)	16.15	0.0001
Yes	1433(31.9)	1204(84.0)	229(16.0)		
Cost of delivery					
Nothing	518(11.5)	394(76.1)	124(23.9)	11.74	0.008
<1200	1562(34.8)	1251(80.1)	311(19.9)		
1200-20000	1993(44.3)	1642(82.4)	351(17.6)		
≥20000	421(9.4)	333(79.1)	88(20.9)		
Received BCG					
Yes	4049(90.1)	3290(81.3)	759(18.7)	12.89	0.0001
No	445(9.9)	330(74.2)	115(25.8)		
Age of mother					
≤20	1248(27.8)	989(79.2)	259(20.8)	2.658	0.265
21-29	2369(52.7)	1929(81.4)	440(18.6)		
30-above	877(19.5)	702(80.0)	175(20.0)		
Antenatal visit					

No visit	970(21.6)	732(75.5)	238(24.5)	20.44	0.0001
Visit	3524(78.4)	2888(82.0)	636(18.0)		
Age of cohabitation					
Early marriage	3382(75.3)	2706(80.0)	676(20.0)	2.56	0.242
Age<-18-30	1107(24.6)	910(82.2)	197(17.8)		
Late marriage	5(.1)	4(80.0)	1(20.0)		
Nutritional status					
Undernourished	1138(25.3)	859(75.5)	279(24.5)	27.73	0.0001
Healthy weight	2607(58.0)	2129(81.7)	478(18.3)		
Over nourished	749(16.7)	632(84.4)	117(15.6)		
Total ever born child					
One	1826(47.2)	1453(79.6)	373(20.4)	5.495	0.64
Two	1342(34.7)	1109(82.6)	233(17.4)		
Three & above	700(18.1)	576(82.3)	124(17.7)		

The binary logistic regressions were used to find the combined and individual effect of socio-economic and demographic factors on LBW child. We considered only significant factors got from Chi-square test as the independent variables of multiple binary logistic regression model. The significant factors were (i) division, (ii) place of residence, (iii) mother's education, (iv) qualified doctor, (v) cost of delivery, (vi) received BCG, (vii) wealth index, (viii) father's education, (ix) sex of child ,(x) toilet facilities, (xi) body mass index, (xii) place of delivery and (xiii) antenatal visit. Since the magnitude of standard error value of all considered independent variables was laid between thus it was 0.001 and 0.5 no evidence of multicollinearity problems and predictors. When we adjusted coefficients and adjusted odds ratio (AOR) it was observed that the LBW was especially pronounced among child who were living in Chittagong division than Barisal division [AOR=0.726; CI: 0.542-0.971; $p<0.05$]. The LBW of children had 0.624-fold higher in Chittagong division than Rajshahi division [AOR= 0.624; CI: 0.462 - 0.842; $p<0.05$]. We also found that division had significant effect on child birth size with the highest number of LBW was found in Chittagong division than Rangpur division [AOR= 0.660; CI: 0.489- 0.889; $p<0.05$]. It was observed that gender had significant effect on child birth size with female child had higher chance to get low birth than male child [AOR=1.232; CI: 1.059-1.432; $p<0.05$]. It was observed that mothers checked up by qualified doctors during their pregnancy period had significant effect on child birth size with mothers who did not check up by qualified doctors had greater chance to get LBW child than who checked up [AOR=1.417;CI:1.060-1.894; $p<0.05$]. Toilet facilities had significant effect on

child birth size with mothers who used unhygienic toilet had greater chance to get LBW child than who used hygienic toilet [AOR=1.206; CI: 1.023-1.421; p<0.05]. We observed that body mass index had significant effect on child birth size with undernourished mothers had higher chance to get LBW child than over nourished mothers [AOR=1.499; CI: 1.158-1.940; p<0.05]. It was observed that cost of delivery had significant effect on child birth size with mothers who expended ≥20000 taka for their delivery had higher chance to receive LBW child than involved <1200 taka [AOR=0.622; CI: 0.442-0.876; p<0.05] and mothers who involved ≥20000 taka in delivery had higher chance of low birth weight than involved <20000 taka [AOR=0.666; CI: 0.499-0.890; p<0.05].

The area under the ROC curve, which ranges from 0 to 1, could also be used to assess the model discrimination. A value of 0.5 means that the model is useless for discrimination (equivalent to tossing a coin) and values near 1 means that higher probabilities will be assigned to cases with the outcome of interest compared to cases without the outcome. From the ROC curve, we found that the ROC area is 0.618 (Figure-1) which means that in almost 62% of all possible pairs of subjects in which one has LBW and the other normal birth weight, this model will assign a higher probability to the subject with child birth size (Table 2).

Table 3shows the classification table to model discrimination. The overall accuracy of this model to predict subjects having LBW (with a predicted probability of 0.5 or greater) is 80.5%. The sensitivity is given by 0/874 = 0.0% and the specificity is 3618/3620 = 99.9%. Positive predictive value means the probability that subjects with a positive screening test truly have the disease. Positive predictive value (PPV) = 0/2 = 0.0% indicates LBW will be occurred. Negative predictive value means the probability that subjects with a negative screening test truly don't have the disease. The negative predictive value (NPV) = 3618/4492= 81% indicates normal birth will be occurred. They found that mother-reported baby birth size had low sensitivity (0.0%) and positive predictive value (0.0%) to indicate low birth weight but had high specificity (99.9%) and negative predictive values (81%).

Table 2: Effect of each socio-economic and demographic variable on child birth size

Variable	B	S.E.	Wald	df	p-value	AOR	95% C.I. for AOR	
							Lower	Upper
Division			32.761	6	0.001			
Barisal Vs Chittagong	-0.321	0.149	4.663	1	0.031	0.726	0.542	0.971
Dhaka Vs Chittagong	0.134	0.125	1.133	1	0.287	1.143	0.894	1.461
Khulna Vs Chittagong	-0.136	0.146	0.861	1	0.353	0.873	0.655	1.163
RajshahiVs Chittagong	-0.472	0.153	9.519	1	0.002	0.624	0.462	0.842
RangpurVs Chittagong	-0.416	0.152	7.471	1	0.006	0.66	0.489	0.889
SylhetVs Chittagong	0.148	0.127	1.354	1	0.245	1.159	0.904	1.487
Residence								
Urban Vs Rural	-0.04	0.094	0.179	1	0.672	0.961	0.8	1.155
Mother educational level			4.389	3	0.222			
No education Vs Higher	0.346	0.201	2.948	1	0.086	1.413	0.952	2.098
Primary Vs Higher	0.124	0.183	0.459	1	0.498	1.132	0.791	1.621
Secondary Vs Higher	0.131	0.162	0.647	1	0.421	1.139	0.829	1.566
Sex of child								
Female Vs Male	0.209	0.077	7.335	1	0.007	1.232	1.059	1.432
Qualified doctor								
No Vs Yes	0.348	0.148	5.528	1	0.019	1.417	1.06	1.894
Wealth index			2.246	2	0.325			
Poor Vs Rich	0.125	0.119	1.103	1	0.294	1.133	0.898	1.429
Middle Vs Rich	0.175	0.118	2.175	1	0.14	1.191	0.944	1.501
Type of toilet facility								
Unhygienic Vs Hygienic	0.187	0.084	4.954	1	0.026	1.206	1.023	1.421
Nutritional status			14.177	2	0.001			
UndernourishedVs Overnourished	0.405	0.132	9.455	1	0.002	1.499	1.158	1.94
Healthy weight Vs Overnourished	0.106	0.118	0.811	1	0.368	1.112	0.882	1.402
Place of delivery								
Hospital Vs Home	0.209	0.141	2.19	1	0.139	1.232	0.935	1.624
Mother cost of delivery			8.391	3	0.039			
Nothing Vs>=20000	-0.41	0.198	4.281	1	0.039	0.664	0.45	0.979
<1200 Vs>=20000	-0.475	0.174	7.407	1	0.006	0.622	0.442	0.876
<20000 Vs>=20000	-0.406	0.148	7.58	1	0.006	0.666	0.499	0.89
Received BCG								
No Vs Yes	0.233	0.121	3.724	1	0.054	1.262	0.996	1.599

Antenatal visit								
No visit Vs Visit	-0.125	0.099	1.6	1	0.206	0.883	0.727	1.071
Father education			3.005	3	0.391			
No education Vs Higher	0.254	0.173	2.143	1	0.143	1.289	0.918	1.81
Primary Vs Higher	0.178	0.159	1.252	1	0.263	1.195	0.875	1.634
Secondary Vs Higher	0.068	0.148	0.213	1	0.644	1.071	0.801	1.432
Constant	-1.902	0.265	51.678	1	0.001	0.149		
Goodness of fit	Hosmer and Lemeshow Test			Chi-square value=8.104			p-value=.423	

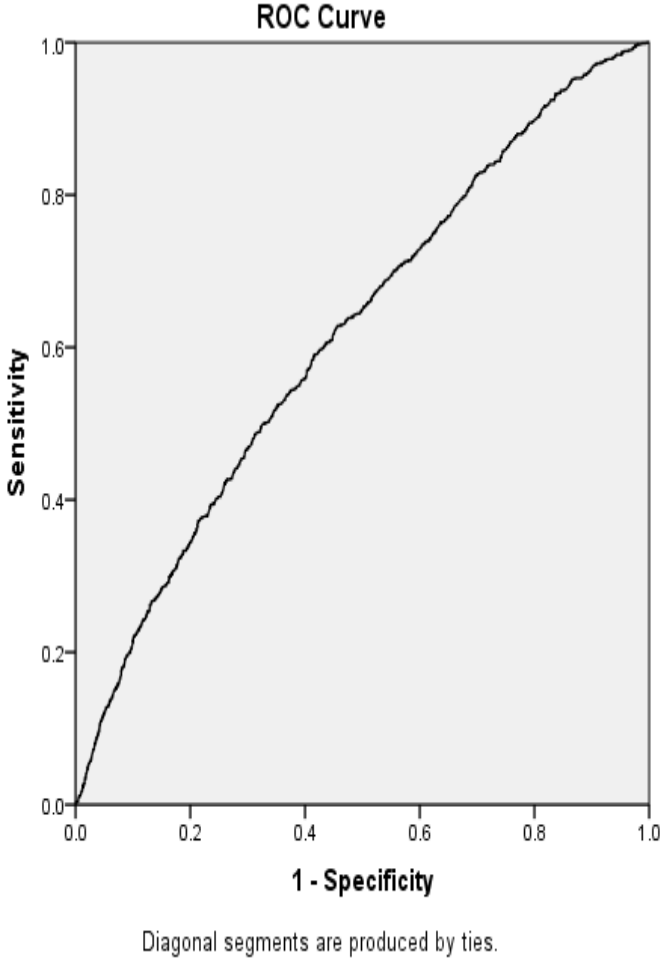

Figure 1: ROC curve for child birth weight

Table 3: The classification table

observed		Predicted		
		Child birth size		Percentage Correct
		Normal	LBW	
Child birth size	Normal	3618	2	99.9
	LBW	874	0	0.0
Overall percentage				80.5

4. Discussion

LBW is a potential indicator of a child's vulnerability to the risk of childhood illness and the child's chances of survival. It is an important determinant of childhood morbidity. The data used in this study, gathered by the BDHS-2014, were nationally representative, covering both urban and rural areas. Previous studies in Bangladesh had examined the relationship between child birth size and division, type of place residence, parent's education, mother's body mass index etc. In this study the overall prevalence of LBW among Bangladeshi children was 19.4%. The prevalence of LBW children is 16% worldwide, and 28% of them are in South Asia while 22% in Bangladesh (UNICEF, 2015). We used frequency distribution, chi-square test, binary logistic regression analysis and multinomial logistic regression for this study. No education and poor economy was the main factors for increasing LBW. Education has been considered as one of the most effective catalysts to change in life style among the population, and government of Bangladesh and various non-government organizations have put in much effort to improve the education of parents on the disadvantage of child LBW. The highest percentage of LBW occurred in uneducated mother which was 27.0%. The highest percentage of LBW children found in uneducated father was 24.7%. The highest percentage of LBW was found in female child (21.0%) than male child (18.0%). The highest number LBW was noted who were living in poor conditions (22.4%) than other two groups; middle (20.2%) and rich (16.2%). The highest prevalence of LBW was occurred when mother didn't check up by qualified doctor (21.1%) than checked up by qualified doctor (16.0%). The percentage of LBW occurred when there was no cost of money includes mother's delivery which was (23.9%).

The prevalence of LBW was found when mothers didn't receive vaccination which was (25.8%). The highest prevalence of number of LBW was found in age group (≤20) (20.8%). Highest number of LBW was found when mother were using unhygienic toilet that was (22.8%) than hygienic toilet (17.3%). The prevalence of highest number of LBW was found in undernourished mothers (24.5%) than compare to healthy weight mothers (18.3%) and over nourished mothers (15.6%). The prevalence of highest number of LBW found when delivery was occurred at home (21.0%) than hospital (17.2%). The mother who did not receive antenatal care during pregnancy had higher chance of LBW child (24.5%) than who was received antenatal visit (18.0%) during pregnancy.

5. Conclusion

This study found high prevalence of low birth weight baby in Bangladesh. It was observed that most of the influential factors are modifiable such as education of father and mother, attendance of qualified doctor, antenatal visit, place of delivery, use of unhygienic toilet, and mother's nutritional status. Proper knowledge among parents about the disadvantage of LBW can be reduced low birth in Bangladesh. Prevalence of low birth weight baby was higher in rural area. Increasing awareness among rural people could help in this regards. Maintaining nutritional status of mother as well as the antenatal care and institutional delivery is always beyond the ability of poor people. Government should have special health programs and provision of incentives for the unprivileged people to reduce the prevalence of low birth weight baby for the future healthy inhabitants.

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