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Factors associated with low birth weight in Afghanistan: a cross-sectional analysis of the demographic and health survey 2015

Rajat Das Gupta,[1,2] Krystal Swasey,[3] Vanessa Burrowes,[4] Mohammad Rashidul Hashan,[5] Gulam Muhammed Al Kibria[3]

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For numbered affiliations see end of article.

Correspondence to
Dr. Rajat Das Gupta;
rajat89.dasgupta@gmail.com

ABSTRACT

Objectives This study aimed to investigate the factors associated with low birth weight (LBW) in Afghanistan.
Design Cross-sectional study.
Setting This study used data collected from the Afghanistan Demographic and Health Survey 2015.
Participants Facility-based data from 2773 weighted live-born children enrolled by a two-stage sampling strategy were included in our analysis.
Primary and secondary outcome measures The primary outcome was LBW, defined as birth weight <2.5kg.
Results Out of 2773 newborns, 15.5% (n=431) had LBW. Most of these newborns were females (58.3%, n=251), had a mother with no formal schooling (70.5%, n=304), lived in urban areas (63.4%, n=274) or lived in the Central region of Afghanistan (59.7%, n=257). In multivariable analysis, residence in Central (adjusted OR (AOR): 3.4; 95% CI 1.7 to 6.7), Central Western (AOR: 3.0; 95% CI 1.5 to 5.8) and Southern Western (AOR: 4.0; 95% CI 1.7 to 9.1) regions had positive association with LBW. On the other hand, male children (AOR: 0.5; 95% CI 0.4 to 0.8), newborns with primary maternal education (AOR: 0.5; 95% CI 0.3 to 0.8), birth interval ≥48 months (AOR: 0.4; 95% CI 0.1 to 0.8), belonging to the richest wealth quintile (AOR: 0.2; 95% CI 0.1 to 0.6) and rural residence (AOR: 0.3; 95% CI 0.2 to 0.6) had decreased odds of LBW.
Conclusions Multiple factors had association with LBW in Afghanistan. Maternal, Neonatal and Child Health programmes should focus on enhancing maternal education and promoting birth spacing to prevent LBW. To reduce the overall burden of LBW, women of the poorest wealth quintiles, and residents of Central, Central Western and South Western regions should also be prioritised. Further exploration is needed to understand why urban areas are associated with higher likelihood of LBW. In addition, research using nationally representative samples are required.

Strengths and limitations of this study

- ► The survey used validated and standardised survey tools to interview survey participants.
- ► We used low birth weight data which were verified through records, preventing recall bias.
- ► The study included only facility-based data because almost of all the home deliveries did not record birth weight, resulting in the exclusion of a significant proportion of the study sample.
- ► Our results lack a temporal relationship between the exposure and the outcome variables due to the cross-sectional design of the study.
- ► Because we included only data from women who survived childbirth, selection bias may have impacted our results.

INTRODUCTION

Globally, there has been a substantial reduction in child mortality over the past few decades; however, significant challenges remain.[1 2] For instance, although under-5 child mortality decreased by 56% between 1990 and 2016, the neonatal mortality declined by only 41% during the same period. Out of the estimated 5.6 million under-5 children who die annually, more than three-fourths die due to preventable causes. These deaths occur mostly in low/middle-income countries (LMICs).[3] Furthermore, the reduction of under-5 mortality has been attributed to the prevention and control of infectious diseases among children one or more years old.[4] Therefore, infant mortality, and particularly neonatal mortality, have become the leading causes of death in children under 5 years.[5] Neonatal deaths alone comprised about half (46%) of the under-5 mortality in 2016.[3]

Low birth weight (LBW), defined as birth weight <2.5 kg irrespective of gestational age,[6] is one of the leading causes of neonatal mortality.[7 8] LBW neonates are prone to develop sepsis, another leading cause of neonatal mortality.[9] Even after this stage in life, these children may suffer long-term neurodevelopmental complications including deficits in cognition, attention and neuromotor functioning.[10 11] LBW is a hindrance for achieving the Sustainable Development Goals' (SDGs) targets related to neonatal and under-5 mortality reduction. The SDGs aim for a reduction of the neonatal mortality rate and under-5 mortality rate to 12 and 25 per thousand live-births by 2030, respectively.[12] Furthermore, achieving these targets could be more challenging for LMICs, as a large proportion of LBW babies are born in these countries.[13–15] Most LMICs including Afghanistan have a higher prevalence of LBW babies compared with developed countries.

Afghanistan is a landlocked country in South Asia. The total area of this country is 652 230 km^2 and the estimated population size is about 34 million.[16] Like other South Asian developing countries, Afghanistan is experiencing a slower reduction in neonatal mortality than under-5 mortality, which may impede the country's progress to achieve the SDG targets.[3 17] While investigating the determinants of early neonatal mortality in Afghanistan, Kibria *et al* found that neonates whose birth size was smaller than average had twofolds higher probability of death compared with neonates of normal birth size.[17] Updated knowledge on the determinants of LBW could help policymakers of Afghanistan plan and design Maternal, Neonatal and Child Health (MNCH) programmes to address this problem. Prior studies that investigated the determinants of LBW in other countries have found that advanced maternal age,[7 8 18] maternal short stature and low body mass index,[13] being a female child,[13 19] poor maternal educational achievement,[7 13 19 20] maternal stress,[21] poor household wealth index[13 19 20] and rural residence[7 8 11 22] were important factors impacting this occurrence. Although other studies have examined the determinants of LBW, there remains a lack of evidence about factors associated with LBW in Afghanistan. We attempted to fill existing gaps in literature to assess the determinants of LBW in Afghanistan using recent data from Afghanistan Demographic and Health Survey (AfDHS) 2015.

METHODS

Data source

The AfDHS 2015 was the first DHS in Afghanistan. The AfDHS 2015 was a cross-sectional survey conducted from June 2015 to February 2016. This survey utilised a nationally representative sample implemented by the Central Statistics Organization and the Ministry of Public Health, Afghanistan.[23]

Sampling design

The AfDHS 2015 used a two-stage sampling strategy to enrol participants. The target group for this survey was women of reproductive age (15–49 years). All residents in selected households were eligible to participate. At the first stage, 950 clusters were randomly selected (260 in urban and 690 in rural areas). A fixed number of 27 households were selected randomly from each cluster.

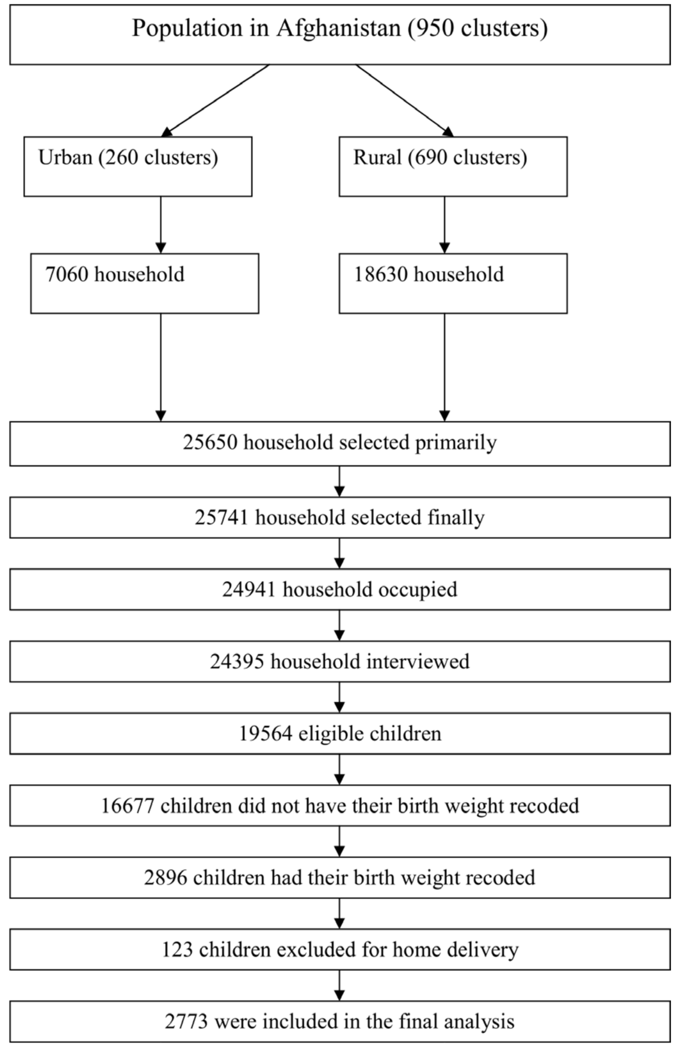

Figure 1 Flowchart showing the process of selecting the participants in the survey.

A total of 25 741 households were selected for the final sample. Among them, 98% of the households provided consent. The detailed sample selection process is shown in figure 1. The details of this survey including survey design, methodologies, questionnaires, sample size calculation and results have been reported elsewhere.[23]

Survey tools and data collection

Three standard sets of questionnaires were used by the AfDHS 2015: women's, men's and household's questionnaires. With the women's questionnaire, information was collected on respondents' background, reproductive health, contraception, pregnancy and postnatal care, child immunisation, health and nutrition, marriage and sexual activity, fertility preferences, husband's background and women's work, HIV/AIDS, other health issues including tuberculosis and hepatitis, fistula, maternal mortality and domestic violence. This questionnaire was adapted according to the local context and pretested to collect the aforementioned information. The questionnaire was then translated into the local

Table 1 List of study variables

Study variables	Description and categories
Outcome variable	Weight of the child at birth (0=normal birth weight (≥2500 g); 1=low birth weight (<2500 g))
Explanatory variables	
Maternal age	Maternal age during child-birth (0= ≤20 years; 1=21–34 years; 2= ≥35 years)
Sex	Sex of the child at birth (0=female; 1=male)
Maternal education	Education level of the mother (0=no formal education; 1=primary; 2=secondary or above)
Maternal occupation	Working status of the mother (0=not working; 1=working)
Preceding birth interval	Interval between last pregnancy and current pregnancy (0=first birth; 1 = <24 months; 2=24–47 months; 3= ≥48 months)
Parity	The number of pregnancies reaching viable gestational age (including live births and stillbirths) (0=primipara (1) ; 1=multipara (2–4) ; 2=grand multipara (≥5)).
Took iron pills	Mother's intake of iron pills during pregnancy of the studied child (0=yes; 1=no).
Number of antenatal care visits	Number of antenatal care visits received by the mother during pregnancy of the studied child (0=no visit (0); 1=inadequate (1–3) ; 2=adequate (≥4))
Household wealth status	Household wealth quintile (0=poorest; 1=poorer; 2=middle; 3=richer; 4=richest)
Place of residence	Type of the cluster (0=urban; 1=rural)
Region of residence	Region of residence within the country (0=North Eastern; 1=North Western; 2=Central Eastern; 3=Central; 4=Central Western; 5=Southern Eastern; 6=Southern Western)

languages (Dari and Pashto) and then back translated into English to maintain the quality. Data were collected through face-to-face interviews.[23]

Study variables

The outcome variable of this study was birth weight, dichotomised into low (<2.5 kg) and normal (≥2.5 kg) birth weights. Trained data collectors asked each respondent (ie, mother) to provide a detailed birth history for children born in the preceding 5 years. The survey included questions about antenatal, delivery and postnatal complications. Birth weights were recorded in grams from birth records.[22] We included birth weight records as these were more reliable than birth weights reported by the mothers, thus reducing the likelihood of introducing recall bias in the study.[24] Only data from the most recent child born were included. Data from mothers with stillbirths were excluded.

Based on literature review and the structure of the AfDHS 2015 dataset, the following independent variables were selected: maternal age (in years), sex of the child, maternal education level, maternal occupation, preceding birth interval (in months), parity (ie, birth order), iron pill consumption, number of visits for antenatal care (ANC), wealth status, place of residence and province of residence.[7 8 11 13 18–20 22] Table 1 provides a description of the study variables along with categories.

Statistical analysis

The observations with missing data were dropped. Weighted descriptive statistics (frequency and percentage) were used to present the sociodemographic characteristics of the respondents. Next, simple and multivariable logistic regression analyses were conducted to investigate the association between LBW with explanatory variables. Variables which showed p<0.20 in bivariate analyses were included in the multivariable model. The significance level of 0.20 was considered sufficient to prevent residual confounding in the final multivariable model.[25] Logistic regression analysis accounted for the cluster sampling design of the survey. Variance inflation factors were used to check multicollinearity among the variables. To assess the internal validity of the regression model, the F-adjusted mean residual goodness-of-fit test was used to measure the internal validity of the regression model.[26] Both unadjusted and adjusted OR (AOR) were reported. Based on the presence of different household assets, the wealth index was calculated. Principal component analysis was used to create the wealth index that was supplied with the data. Then, the wealth index was divided into quintiles to calculate the wealth status of the respondents.[23] All the analyses were done using Stata V.13.0.[27] The authors followed the guidelines outlined in the Strengthening the Reporting of Observational Studies in Epidemiology statement in writing the manuscript (online supplementary file 1).

Ethical consideration

Informed consent was taken from the participants. In cases of minor participants, the assent form was signed by the respondents and written informed consent was given by the adult guardian.[24] Data were accessed from the DHS programme with prior approval.

Patient and public involvement

Patients were not involved in the study. This household-based survey collected data from women of reproductive age (15–49 years).

RESULTS

Characteristics of the study sample

A total of 2896 weighted children had birth weight measurements taken. Among them, 123 had home deliveries and were excluded. The final sample size of this study was 2773 children. Table 2 presents the weighted distribution of the respondents according to background characteristics. Of the included children, 2342 (84.5%) had normal birth weight and 431 (15.5%) children had LBW. More than half of the surveyed children were males (53.3%, n=1477). However, a greater proportion of female children had LBW than normal weight (58.3% (n=251) vs 44.6% (n=1045)). Approximately three-fifths (60.7%, n=1683) of mothers did not receive any formal education, higher among the LBW children (70.5% (n=304) vs 58.9% (n=1378)). Less than half of the mothers (44.0%, n=1221) received four or more ANC visits, but 15.2% (n=420) of them never attended any ANC visits. Preceding births (43.3%, n=1202) mostly took place between 24 and 47 months. Around one-fifth of the surveyed children were the first birth (20.7%, n=574), and this proportion was greater among LBW children than normal birth weight children (24.3% (n=105) vs 20.0% (n=469)). Nearly half (47.5%, n=1316) of the respondents belonged to the richest wealth quintile. Almost equal proportions of the children were from urban (51.4%, n=1425) and rural areas (48.6%, n=1348). The unweighted distribution of the respondents (n=2533) is shown in online supplementary table 1.

Factors associated with LBW

Table 3 shows the results of the logistic regression analyses. In the final model, sex of the child, maternal education, preceding birth interval, wealth status, place of residence and region of residence were significant factors associated with LBW. A male child had almost 50% lower odds (AOR: 0.5; 95% CI 0.4 to 0.8) of having LBW compared with a female child. Mothers who received primary education (AOR: 0.5; 95% CI 0.3 to 0.8) had significantly lower odds of delivering a LBW baby compared with mothers without any formal education. Children born after a birth interval of ≥48 months were less likely to have LBW (AOR: 0.3; 95% CI 0.1 to 0.8) compared with the first-born child. The odds of having a LBW child decreased with higher wealth index; middle (AOR:0.4; 95% CI 0.2 to 0.9), richer (AOR: 0.3; 95% CI 0.1 to 0.6) and richest (AOR: 0.2; 95% CI 0.1 to 0.6) quintiles had significant reductions. Children in rural regions had 70% lower odds of LBW (AOR: 0.3; 95% CI 0.2 to 0.6) than their urban counterparts. Compared with the North Eastern region, however, respondents living in Central (AOR: 3.4; 95% CI 1.7 to 6.7), Central Western (AOR: 3.0; 95% CI 1.5 to 5.8) and Southwestern (AOR: 4.0; 95% CI 1.7 to 9.1) regions were more likely to have children with LBW. The multivariable logistic regression without the sex variable (online supplementary table 2) and separate analyses for male (online supplementary table 3) and female (online supplementary table 4) children yielded similar results. However, in case of female children, no intake of iron tablets by the mother during pregnancy was positively associated with LBW (AOR: 0.6; 95% CI 0.4 to 0.9). Inadequate and adequate ANC visits were also positively associated with LBW in female child (AOR: 7.7; 95% CI 1.6 to 36.0 and AOR: 5.7; 95% CI 1.9 to 17.1, respectively) (online supplementary table 4).

DISCUSSION

In this study, we investigated the factors associated with LBW among hospital-born babies in Afghanistan. The following factors had significant association with LBW after adjustment: female child, lower maternal education, poor wealth index, urban residence and residence in Central, Central Western and Southwestern regions. To the best of our knowledge, this is the first epidemiological study to investigate determinants of LBW in Afghanistan.

We showed that female children had higher odds of having LBW than male children. This result is similar to the findings of a multicountry study that analysed DHS data from 10 developing countries.[13] The birth weight of male children is usually higher than female children.[28] This difference starts after 28 weeks of gestation. Although the exact mechanism impacting the difference in birth weight is unknown, it might be due to androgen activities or the Y chromosome that carries genetic material for fetal growth. As a result, male children could have higher intrauterine growth and birth weight than their female counterparts.[29]

Poor maternal education was also associated with LBW in our study. This finding is also consistent with previous studies done in developing countries.[7 13 19 20 30 31] LBW of these children may be due to less access to healthcare, and less awareness about prenatal care. All of these factors could have an adverse effect on fetal growth and increase a mother's chances of delivering a LBW child.[31] Therefore, educational interventions for women are needed in order to reduce the prevalence of LBW in Afghanistan. Similarly, lower wealth index had a positive association with LBW, which is also consistent with findings from other LMICs.[13 19 20 32] A woman from

Table 2 Distribution of study children according to background characteristics (n=2773)

Variables	Total (n=2773)		Normal birth weight (n=2342)		Low birth weight (n=431)	
	Frequency	%†	Frequency	%†	Frequency	%†
Maternal age (years)						
≤20	316	11.4	280	11.9	36	8.4
21–34	2119	76.4	1756	75.0	363	84.3
35–49	338	12.2	306	13.1	32	7.3
Sex of child*						
Male	1477	53.3	1297	55.4	180	41.7
Female	1296	46.7	1045	44.6	251	58.3
Maternal education						
No education	1683	60.7	1378	58.9	304	70.5
Primary	400	14.4	350	14.9	51	11.7
Secondary or above	690	24.9	613	26.2	77	17.8
Maternal occupation						
Not working	2493	89.9	2097	89.6	396	91.8
Working	280	10.1	244	10.4	35	8.2
Preceding birth interval (months)						
First birth	574	20.7	469	20.0	105	24.3
<24	518	18.7	441	18.8	77	17.9
24–47	1202	43.3	996	42.6	205	47.6
≥48	479	17.3	435	18.6	44	10.2
Parity						
Primipara	574	20.7	469	34.7	105	24.3
Multipara	1244	44.8	1060	45.3	184	42.6
Grand multipara	955	34.5	813	20.0	132	33.1
Took iron pills						
No	811	29.2	714	30.5	97	22.6
Yes	1962	70.8	1628	69.5	334	77.4
Number of ANC visits						
No (0)	420	15.2	375	16.0	45	10.4
Inadequate (1–3)	1132	40.8	942	40.3	189	43.9
Adequate (4 or more)	1221	44.0	1024	43.8	197	45.7
Wealth status						
Poorest	220	7.9	173	7.4	47	10.9
Poorer	288	10.4	248	10.6	40	9.2
Middle	321	11.6	277	11.8	43	10.0
Richer	628	22.6	558	23.8	71	16.4
Richest	1316	47.5	1086	46.4	231	53.5
Place of residence						
Urban	1425	51.4	1151	49.2	274	63.4
Rural	1348	48.6	1190	50.8	158	36.6
Region of residence*						
North Eastern	213	7.7	194	8.3	19	4.5
North Western	465	16.8	429	18.3	37	8.5
Central East	179	6.5	165	7.0	14	3.2
Central	1274	45.9	1017	43.4	257	59.7

Continued

Table 2 Continued

Variables	Total (n=2773) Frequency	%†	Normal birth weight (n=2342) Frequency	%†	Low birth weight (n=431) Frequency	%†
Central Western	341	12.3	276	11.8	64	14.9
Southern Eastern	225	8.1	197	8.4	28	6.5
Southern Western	76	2.7	64	2.8	12	2.7

* P<0.05.
†Column percentage.
ANC, antenatal care.

a lower socioeconomic background may also have poor educational attainment and knowledge, ability or awareness about maternal care, thereby increasing the risk for LBW.[19] MNCH programmes in Afghanistan should target poor socioeconomic groups for the prevention of LBW.

Our results also showed that duration of preceding birth interval was associated with LBW. In our study, a preceding birth interval of ≥48 months had lower odds of LBW than if the child was the first born. Other studies found that short interpregnancy intervals were a strong risk factor for LBW.[33–36] One explanation is that longer birth intervals allow mothers to recover physically and psychologically, and may also improve nutritional status—all of which have a positive effect on fetal growth.[37] Kibria and colleagues showed that shorter interpregnancy interval was also an important risk factor for early neonatal mortality in Afghanistan.[17] Promotion of birth spacing or family planning can be a beneficial intervention to prevent LBW, and may thereby improve prevention of neonatal mortality in Afghanistan.

We observed that urban residents had a higher likelihood of delivering an LBW baby. This finding is discrepant with previous studies where rural residence was found to be a significant risk factor.[7 8 11 22] Further exploration is needed to determine what factors influence LBW in the urban areas of Afghanistan. Residence in Central, Central Western and Southwestern regions of Afghanistan also had a higher probability of LBW. The regional inequality in LBW has been noted in other studies.[38 39] These regional pockets should be given additional emphasis to reduce the geographical inequity.

Although advanced maternal age is a known risk factor for LBW,[7 8 13 18 40] no significant association was observed in this study. Perhaps if appropriate nutrition is maintained and mothers receive proper ANC, giving birth to a normal weight baby may be possible despite advanced maternal age.[41 42] We did not find any association between number of ANC visits and LBW either. In previous studies, inadequate number of ANC visits was an important risk factor of LBW.[13 43] This may be due to the inclusion of only facility births data in our study to capture birth weights. Mothers who opt for a facility birth tend to have more ANC visits.[44] This could mask the investigated association. Also, the positive association between maternal intake of iron tablets during pregnancy and LBW in the female child contradicts the existing literature.[13] Further, adequate number of ANC was positively associated with LBW in female children, which is in contrast with the literature.[13 43] These findings may be spurious, which needs further exploration.

Strengths and limitations

Our study has several notable strengths. First, the AfDHS 2015 used validated and standardised survey tools to interview survey participants. Second, this study used LBW data which were verified through records, removing the opportunity for recall bias. However, limitations of the present study also warrant discussion. This study included only facility-based data because almost none of the home deliveries recorded birth weight. Therefore, a significant proportion of study samples were excluded from the study. As this is a cross-sectional study, we cannot ensure a temporal relationship between the exposure and the outcome variables. Only the data of survived women were analysed, therefore excluding determinants of the more adversely affected mothers may cause additional selection bias. We did not investigate some known risk factors for LBW including genetic[45 46] or environmental factors[47–49] due to limitations of the AfHDS 2015 dataset. As the instruments used to measure birth weight were not calibrated or validated by the survey team, this could also cause some misclassification, though this misclassification is more likely to be non-differential in nature. Lastly, we do not know the exact timing of the birth weight measurement, thus adding some additional misclassification, as it is recommended to measure birth weight immediately after birth.[50]

CONCLUSIONS

This study identified several determinants of LBW in Afghanistan. Female children, lower maternal education, poor wealth index, urban residence and residing in Central, Central Western and South Western regions

Table 3 Bivariate and multivariable logistic regression to identify factors influencing low birth weight in Afghanistan

Variables	COR (95% CI)	AOR (95% CI)†
Maternal age (years)		
≤20	Ref.	
21–34	1.6 (0.8 to 3.3)	
35–49	0.8 (0.3 to 2.0)	
Sex of child		
Male	0.6* (0.4 to 0.9)	0.5** (0.4 to 0.8)
Female	Ref.	Ref.
Maternal education		
No education	Ref.	Ref.
Primary	0.7‡ (0.4 to 1.0)	0.5*** (0.3 to 0.8)
Secondary or above	0.6 (0.2 to 1.4)	0.3 (0.1 to 1.0)
Maternal occupation		
Not working	Ref.	
Working	0.8 (0.3 to 2.0)	
Preceding birth interval (months)		
First birth	Ref.	Ref.
<24	0.8 (0.4 to 1.7)	0.8 (0.3 to 1.8)
24–47	0.9 (0.5 to 1.6)	0.8 (0.5 to 1.4)
≥48	0.5* (0.2 to 0.9)	0.3* (0.1 to 0.8)
Parity		
Primipara	Ref.	
Multipara	0.8 (0.5 to 1.3)	
Grand multipara	0.8 (0.4 to 1.6)	
Took iron pills		
Yes	Ref.	Ref.
No	0.7‡ (0.4 to 1.1)	0.8 (0.4 to 1.3)
Number of ANC visits		
No visits (0)	Ref.	Ref.
Inadequate (1–3)	1.7 (0.5 to 5.3)	2.3 (0.5 to 9.6)
Adequate (4 or more)	1.6‡ (0.8 to 3.2)	2.1 (0.8 to 5.1)
Wealth status		
Poorest	Ref.	Ref.
Poorer	0.6 (0.3 to 1.2)	0.5 (0.2 to 1.1)
Middle	0.6 (0.3 to 1.2)	0.4* (0.2 to 0.9)
Richer	0.5‡ (0.2 to 1.0)	0.3*** (0.1 to 0.6)
Richest	0.8 (0.3 to 1.9)	0.2*** (0.1 to 0.6)
Place of residence		
Urban	Ref.	Ref.
Rural	0.6‡ (0.3 to 1.0)	0.3*** (0.2 to 0.6)
Region of residence		
North Eastern	Ref.	Ref.
North Western	0.9 (0.5 to 1.6)	0.9 (0.5 to 1.7)
Central East	0.8 (0.4 to 1.7)	0.9 (0.4 to 1.9)
Central	2.5** (1.3 to 5.1)	3.4*** (1.7 to 6.7)
Central Western	2.3** (1.2 to 4.4)	3.0*** (1.5 to 5.8)
Southern Eastern	1.4‡ (0.9 to 2.3)	1.8 (0.9 to 3.5)
Southern Western	1.8‡ (1.0 to 3.2)	4.0*** (1.7 to 9.1)

Continued

Table 3 Continued

*P<0.05, **P<0.01, ***P<0.001.
†Variables with p<0.2 from unadjusted model were included into multivariable analysis.
‡P<0.2.
ANC, antenatal care; AOR, adjusted OR; COR, crude OR.

of Afghanistan were important factors associated with LBW. Significance of factors from different levels indicate that a multifaceted approach is required to address the factors that have positive association with LBW. From a programme planning perspective, to reduce the overall burden of LBW as well as lowering the childhood deaths in Afghanistan, policymakers and researchers should address these factors when forming programmes on a country-wide basis. The regional pockets with high probability of having LBW (urban area and Central, Central Western, Southern Western regions of Afghanistan) should be given priority to reduce inequity. Maternal education should be promoted and women from the poorest wealth quintiles should be targeted by the MNCH programmes in order to prevent LBW.

Author affiliations
[1]Centre for Science of Implementation and Scale-Up, BRAC James P Grant School of Public Health, BRAC University, Dhaka, Bangladesh
[2]Centre for Non-Communicable Diseases and Nutrition, BRAC James P Grant School of Public Health, BRAC University, Dhaka, Bangladesh
[3]Department of Epidemiology and Public Health, School of Medicine, University of Maryland, Baltimore, MD-21201, United States of America
[4]Department of International Health, Bloomberg School of Public Health, Johns Hopkins University, Baltimore, MD-21205, United States of America
[5]Dhaka Medical College and Hospital, Dhaka, Bangladesh

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