ISSN: 2469-5823

Teklu et al. Int Arch Nurs Health Care 2023, 9:182
DOI: 10.23937/2469-5823/1510182
Volume 9 | Issue 1
Open Access

International Archives of
Nursing and Health Care

RESEARCH ARTICLE

The Effect of Antenatal Care on Birth Weight in Low and Middle Income Countries

Rediet Eristu Teklu[1*], Fantu Mamo Aragaw[1], Adugnaw Zeleke Alem[1], Tsegaw Amare[2] and Biresaw Ayen Tegegne[3]

[1]*Department of Epidemiology and Biostatistics, Institute of Public Health, College of Medicine and Health Sciences, University of Gondar, Gondar, Ethiopia*

[2]*Department of Health Systems and Policy, Institute of Public Health, College of Medicine and Health Sciences, University of Gondar, Gondar, Ethiopia*

[3]*Department of Anesthesia, School of Medicine, College of Medicine and Health Sciences, University of Gondar, Gondar, Ethiopia*

***Corresponding author:** *Rediet Erist Teklu, Department of Epidemiology and Biostatistics, Institute of Public Health, College of Medicine and Health Sciences, University of Gondar, Gondar, Ethiopia, Tel: +251927431920*

Abstract

Background: Low birth weight (LBW) defined by WHO as weight at birth of less than 2.5 kg. LBW accounts for nearly half of all perinatal and one-third of all infant deaths. Around 20 million LBW babies are born each year, with 95.6% of them in developing countries. Antenatal care can significantly mitigate the incidence of low birth weight (LBW) in low and middle income countries, according to studies. The purpose of this paper is to assess the effect of antenatal care on LBW using the most recent DHS data since 2012 for each country.

Methods: This study was based on the most recent Demographic and Health Survey (DHS) data of 52 low and middle income countries. A total of 228,907 women aged 13-49 years were included in the study. Logistic regression model was applied. $P < 0.05$ was considered statistically significant for all tests performed in the study. In the multivariable, the Adjusted Odds Ratio (AOR) with 95% Confidence Interval (CI) was reported for potential determinant factors of LBW.

Result: The overall prevalence of low birth weight in low and middle income countries is 11.3% [95% CI: 11.2%, 11.4%]. Most of the women (47.8%) who had given birth five years preceding the survey were young, aged 25-34 years. Sex of child, maternal education, birth order, preceding birth interval, residence, type of birth, wealth status, four and above ANC were found to be significant determinant of low birth weight.

Conclusion: low birth weight is still a major public health problem in low and middle income countries. Enhancing maternal education and quality ANC service is recommended to reduce LBW. In addition it is better to strength economy of family with special attention multiple birth.

Keywords

Antenatal care, Low birth weight, Low and middle income countries

Abbreviations

ANC: Antenatal Care; AOR: Adjusted Odd Ratio; CI: Confidence Interval; LBW: Low Birth Weight; WHO: World Health Organization

Background

World health organization defines low birth weight (LBW) as birth weight of less than 2.5 kg [1]. A birth weight of less than 2500 grams has been agreed upon as the international standard for low birth weight (LBW). Preferably, the measurement is made within the first hour of life, before significant postnatal weight loss has taken place [2]. Infants born at LBW have serious health and developmental problems, which can have a significant financial impact on society [3]. Low birth weight is linked to an increased risk of disease and death, compromised immune system, and delayed cognitive development [4].

Citation: Teklu RE, Aragaw FM, Alem AZ, Amare T, Tegegne BA (2023) The Effect of Antenatal Care on Birth Weight in Low and Middle Income Countries. Int Arch Nurs Health Care 9:182. doi.org/10.23937/2469-5823/1510182

Accepted: April 03, 2023: **Published:** April 05, 2023

One-third of infant mortality and nearly half of all perinatal deaths are caused by LBW [5]. Low birth weight babies have a 40 times higher mortality rate within the first four weeks of life than babies with normal birth weights. Babies with LBW account for 1/3 of all infant fatalities and half of all perinatal deaths [2]. According to WHO estimates, each year, more than 20 million LBW babies are born throughout the world, accounting for 15.5% of all live births and roughly 95.6% of them in developing nations [6].

According to regional statistics, low- and middle-income countries (LMICs), which account for almost all occurrences of LBW, bear a disproportionately heavy burden of newborn death globally [5]. Burkina Faso, Ghana, Malawi, Senegal, and Uganda each have a prevalence of LBW of 13.4%, 10.2%, 12.1%, 15.7%, and 10%, respectively [7].

Numerous studies conducted in developing countries have shown that raising the standard of prenatal care (ANC) can dramatically lower the incidence of LBW. Accessibility to ANC, the number of ANC visits, and the content of ANC are all indicators of quality ANC [8-10].

The purpose of this paper is to assess the effect of antenatal care on low birth weight in low and middle income countries using the most recent DHS data since 2012 for each country.

Methods

Data sources

Our study analyzed DHS data from 52 low- and middle-income nations. The DHS was created in the 1980s as a nationally representative household survey by the United States Agency for International Development (USAID) [11]. We analyzed all nations with surveys conducted since 2012. When more than one survey has been conducted since 2012, we choose the most recent one for each country.

Variables and measurements

Dependent variable: This study analyzed only the numerical birth weight data contained in the DHS survey for only the most recent children. Finally, birth weight data were classified into two groups: Normal birth weight (birth weight ≥ 2500 g-4000 g) or LBW (birth weight < 2500 g). Data from children with a missing birth weight and overweight children were excluded from the analysis.

Independent variables: Child birth weight is influenced by a number of circumstances, including the ANC. ANC is linked to socioeconomic factors as wealth index, employment status, and educational attainment. Birth weight is affected by ANC as well as other health factors including the location of the delivery. These characteristics are linked to the outcome of interest in a similar way to maternal factors as the age of mothers, maternal educational status and others. In addition to maternal factors connected to ANC and birth weight, socioeconomic factors are also linked to child parameters such as birth order and prior birth interval.

Statistical analysis

The study population characteristics for the chosen countries were expressed as percentages (%) with a 95% confidence interval (CIs) in the descriptive analysis. After taking into account potential confounders, a multivariate logistic regression model was used to estimate ORs as a measure of the relationships between LBW and related risk factors. The analysis made use of the diagnostic tests. The Hosmer and Lemeshow statistic was used to assess goodness of fit [12]. To find out if multi-collinearity existed, the variance inflation factor (VIF) test was used. Stata version 14 was used for all statistical analyses and $p < 0.05$ was considered statistically significant for all tests performed in the study.

Result

A total of 228,907 women aged 13-49 years formed a sample in this study. Most of the women who had given birth five years preceding the survey were young, aged 25-34 years with 109,330 (47.8%), had secondary level of education 87,540 (38.2%), were working currently 118,510 (52.1%) and 154,122 (67.3%) were currently married. Of these women, almost 133738 (61.9%) perceived the distance to the health center as not a big problem and 128,078 (56.0%) women were from rural areas. The overall prevalence of low birth weight in low and middle income countries is 11.3% [95% CI: 11.2%, 11.4%] (Table 1 and Table 2).

The odds of having low birth weight among poorer, middle, richer and richest household wealth were decreased by 11% [AOR = 0.89, 95% CI: 0.84, 0.94], 20% times [AOR 0.80, 95% CI: 0.75, 0.84), 15% [AOR 0.75, 95% CI: 0.71, 0.80], and 33% [AOR 0.67, 95% CI: 0.67, 0.071] compared to poorest household wealth, respectively. Second of multiple and third of multiple births had 8.25 times [AOR 8.25, 95% CI: 7.63, 8.92] and 33.81 times [AOR 33.81, 95% CI: 16.49, 69, 40] higher odds of having low birth weight compared to single births, respectively. Children who were 2^{nd}, 3^{rd}, 4^{th}, 5^{th}, and 6^{th} and above birth order had 12% [AOR 0.88, 95% CI: 0.81, 0.96], 13% [AOR 0.87, 95% CI: 0.80, 0.95], 9%[AOR 0.91, 95% CI 0.84, 0.99], 12% [AOR 0.88, 95% CI: 0.80, 0.95], and 7% [AOR 0.93, 95% CI: 0.87, 0.99] lower odds of having low birth weight compared to first birth respectively.

Female children, later wanted and no more wanted pregnancy had 1.28 times [AOR 1.28; 95% CI: 1.24, 1.33], 1.08 times [AOR 1.08, 95%CI: 1.03, 1.14] and 1.21 times [AOR 1.21, 95% CI: 1.14, 1.29] higher odds of being low birth weight compared to male children and wanted pregnancy. The odds of low birth weight among autonomous women, optimal and long preceding birth

Table 1: Descriptive characteristics of child birth weight among reproductive health women in low and middle income countries.

Variables	Frequency	Percent
Age (years)		
Less than 24	68,372	29.9
25-34	109,330	47.8
35-49	51,205	22.3
Women's educational level		
No education	43,150	18.9
Primary	72,735	31.8
Secondary	87,540	38.2
Higher	25,482	11.1
Husband's educational level		
No education	37,758	19.2
Primary	56,844	28.8
Secondary	77,580	39.4
Higher	24,960	12.7
Current marital status		
Never in union	15,916	7.0
Married	154,122	67.3
Living with partner	42,612	18.6
Widowed	2,546	1.1
Divorced	3,372	1.5
separated	10,339	4.5
Current working status		
No	109,062	47.9
Yes	118,510	52.1
Sex of child		
Male	112,151	50.93
Female	108,039	49.07
Sex of household head		
Male	173,764	78.9
Female	46,426	21.1
Type of birth		
Single birth	216,090	98.1
2nd of multiple	4,035	1.8
3rd of multiple	65	0.03
Wealth index		
Poorest	44,640	19.5
Poorer	45,824	20.0
Middle	45,980	20.1
Richer	46,482	20.3
Richest	45,951	20.1
Wanted pregnancy		
Then	158,015	71.8
Later	44,383	20.2
No more	17,754	8.1
Terminated pregnancy		
No	179,058	84.1
Yes	33,861	15.9
Media exposure		
No	75,000	34.1
Yes	144,927	65.9
Women's autonomy		
No	27,843	14.8
Yes	160,431	85.2
Residence		
Urban	100,829	44.0
Rural	128,078	56.0
Preceding birth interval		
Short (< 24)	26,081	15.8
Optimal (24-59)	98,236	59.4
Long (> 60)	40,885	24.8

Table 2: Factors associated with low birth weight in low and middle income countries.

Variables	AOR with 95%
Maternal age (in years)	
< 24	1
25-34	0.89 (0.84, 0.93)
35-49	1.0 (0.91, 1.02)
Maternal education	
No formal education	1
Primary	0.81 (0.77, 0.86)
Secondary	0.80 (0.75, 0.85)
Higher	0.78 (0.71, 0.85)
Husband education	2
No formal education	1
Primary	0.93 (0.88, 0.99)
Secondary	0.92 (0.87, 0.98)
Higher	0.84 (0.76, 0.91)
Household wealth status	
Poorest	1
Poorer	0.89 (0.84, 0.94)
Middle	0.80 (0.75, 0.84)
Richer	0.75 (0.71, 0.80)
Richest	0.67 (0.67, 0.071)
Ever had a terminated pregnancy	
No	1
Yes	1.08 (1.03, 1.14)
Child is twin	
Single birth	1
2nd of multiple	8.25 (7.63, 8.92)
3rd of multiple	33.81 (16.49, 69,40)
Family size	
≤ 5	1
6-10	0.93 (0.89, 0.96)

≥ 11	0.84 (0.84, 0.96)
Media exposure	
No	1
Yes	1.04 (1, 1.08)
Preceding birth interval	
Short	1
Optimal	0.83 (0.79, 0.87)
Long	0.88 (0.83, 0.94)
Birth order	
1st	1
2nd	0.88 (0.81, 0.96)
3rd	0.87 (0.80, 0.95)
4th	0.91 (0.84, 0.99)
5th	0.88 (0.80, 0.95)
6 and above	0.93 (0.87, 0.99)
Wanted pregnancy	
Then	1
Later	1.08 (1.03, 1.14)
No more	1.21 (1.14, 1.29)
Women's autonomy	
No	1
Yes	0.98 (0.93, 1.03)
Sex of child	
Male	1
Female	1.28 (1.24, 1.33)
Sex of household	
Male	1
Female	1.02 (0.07, 1.08)
Women's currently working	
No	1
Yes	0.77 (0.74, 0.80)
Number of ANC	
≤ 3	1
≥ 4	0.86 (0.82, 0.89)
Residence	
Urban	1
Rural	0.84 (0.81, 0.88)

interval decreased by 2% [AOR 0.98, 95% CI 0.93, 1.03], 17% [AOR 0.83, 95% CI: 0.79, 0.87] and 12% [AOR 0.88, 95% CI: 0.83, 0.94] compared to those women who don't have an autonomy and low preceding birth interval.

The odds of a higher level of low birth weight among children from the rural and family size of 6-10 and > 10 decreased by 16% [AOR 0.84, 95% CI 0.81, 0.88], 7% [AOR 0.93, 95% CI: 0.89, 0.96] and [AOR 0.84, 95% CI 0.84, 0.96] compared to children from urban and family size less than 6, respectively. Women who had primary, secondary and higher education had lower odds of having low birth weight than women who hadn't formal education, and those whose partners had primary, secondary and higher education.

Discussion

We looked into the effect of ANC visits and other variables on infant birth weight using information from extensive, nationally representative demographic and health surveys from low- and middle-income countries.

Low birth weight is still a significant public health issue in low and middle income nations, as evidenced by our investigation the prevalence is 11.3% [95% CI: 11.2%, 11.4%]. Our finding was higher than systematic and meta-analysis results in Iran 8.5% [13], Nepal 9.4% [14], Nigeria 6.3% [15], China 5.1% [16]. Our finding was lower than a study done in Kenya 12.3% [17], Jordan 13.8 [18], a systemic and meta-analysis result done in Ethiopia 14.1% [19]. Additionally, the national, regional, and global systematic analysis found that the result of this study was lower than estimates for the world and sub-Saharan countries of 14.6% and 16.4% [20]. This may be related to measures taken to reduce maternal and newborn deaths in low-income countries [21].

Several factors contributed for the occurrence of low birth weight. Poorer, middle, richer and richest wealth status associated with a reduced probability of LBW compared to the poorest. This finding is supported by other studies [18,22]. This demonstrates that, as shown in other settings, poverty plays a significant role in determining birth weight [23,24]. Additionally, low-income households might not be able to afford proper prenatal care [25], compared to more affluent mothers, low-income mothers consume less food overall [26].

Numerous studies have found a U-shaped relationship between maternal age and LBW, with teenagers and older mothers having the highest risk [12,27]; however, this particular trend was not revealed by our data neither was associated with LBW.

Female sex of child was statistically significant factor for higher odds of LBW, this finding supported by other studies in Jordan and Ethiopia [18,28]. The relationship may result from male fetuses being expelled later than female fetuses, so that males are more likely to be macerated [29].

Furthermore, we found that multiple births, later wanted and no more wanted pregnancies had higher odds of LBW compared to single birth, male children and wanted pregnancy. Agreeing with previous studies, the odds of LBW decreased as the level maternal education increased [14,18]. Women with little to no education and/or understanding are more likely to engage in unhealthy behaviors (e.g., smoking, drug or substance uses, etc.). Furthermore, they might not have access to adequate healthcare resources (such as prenatal care or iron supplements), which could have an impact on fetal growth [30].

Poor maternal education, rural residence and large family size were significantly associated with increased odds of LBW. This is in line with previous studies [18,19].

This may be because the woman lives in an urban area rather than a rural one, where access to medical services, health knowledge, and dietary awareness are more prevalent [31].

The present study showed that the odds of LBW decreased among the mothers who had optimal and long preceding birth interval. It is consistent with studies done in India [32], Jordan [18]. The maternal nutritional depletion hypothesis, which claims that a close succession of pregnancies and the lactation period worsen the mother's nutritional status and that there is insufficient time for the mother to recover from the physiological stress and strain of the prior pregnancy before she is subjected to the stresses of the next, is one explanation for the connection between short birth interval and LBW [33].

Autonomous women and higher birth order associated with lower odd of LBW. This is supported by other studies [34,35]. This could be as a result of low levels of autonomy in health care decision-making, which can result in low consumption of prenatal food and micronutrient supplementation, which could lead to subpar prenatal care, subpar maternal health and nutritional status, and subpar fetal growth resulting to LBW [36].

This study found a strong association between having greater than or equal to four ANC visit and reduced the odds of LBW and the result is in agreement with previous studies [15] this is as a result of antenatal care providing routine height and weight monitoring, detection of medical issues with the mother or the fetus, advise against cigarette or drug use, psychosocial support, nutritional guidance, and early intervention that may reduce adverse pregnancy outcomes, such as LBW [37].

Limitation of the Study

The limitation of this study is that not include some important predictors like maternal weight and anemia.

Conclusion

A major public health issue in low- and middle-income nations continues to be low birth weight. Low birth weight was found to be significantly affected by the child's sex, the mother's education, the child's birth order, the time between births, the residence, the type of birth, the wealth status, and ANC visits of four and above. This conclusion shows that strengthening women's autonomy and women's with multiple births should receive more attention. In order to reduce LBW, it is also crucial to improve family economic condition, access to education, and quality ANC service.

Declarations

Ethics approval and consent to participate

This study was conducted under the Declaration of Helsinki and since we were using publicly accessible data, ethical approval was not needed. However, by registering or online requesting, we accessed the data set from the DHS website (https:/dhsprogram.com) and no personal identifiers were found in the data set.

Consent for publication

Not applicable.

Availability of data and materials

Data is available online and you can access it from https://dhsprogram.com/data/dataset_admin/index.cfm

Competing interests

The authors declare that they have no competing interests.

Funding

No funding was available for this study.

Acknowledgement

We would like to acknowledge the measure DHS program which granted as permission to use DHS data.

Authors contributions

RET developed the research protocol and tool, trained the data collector, supervise the data collection, managed and analyzed the data, interpreted the findings, and wrote the manuscript. FMA and AZA have been involved in research protocol and tool development, trained the data collector, supervises the data collection, managed and analyzed the data, interpreted the findings, and wrote the manuscript. TA and BAT have been involved in research protocol and tool development managed and analyzed the data, interpreted the findings, and wrote the manuscript. RET, FMA, AZA, TA and BAT have been involved in research protocol and tool development, supervise the data collection, and wrote the manuscript. Finally, all authors read and approved the revised manuscript.

References

1. World Health Organization (1992) International statistical classification of disease and related health problems. Tenth Revision, 1992 (ICD-10), Geneva.
2. Park K (2009) Park's textbook of preventive and social medicine. (20th edn), Banarsidas Bhanot Publishers, Jabalpur.
3. Almond D, Chay KY, Lee DS (2005) The Costs of Low Birth Weight. The Quarterly Journal of Economics 120: 1031-1083.
4. Alderman H, Behrman JR (2006) Reducing the incidence of low birth weight in low-income countries has substantial economic benefits. World Bank Research Observer 21: 25-48.
5. Metgud CS, Naik VA, Mallapur MD (2012) Factors affecting birth weight of a newborn--a community based study in rural Karnataka, India. PLoS One 7: e40040.

6. Sachdev HPS (2001) Low birth weight in South Asia. Int J Diab Dev Countries 21: 13-31.
7. He Z, Bishwajit G, Yaya S, Cheng Z, Zou D, et al. (2018) Prevalence of low birth weight and its association with maternal body weight status in selected countries in Africa: A cross-sectional study. BMJ Open 8: e020410.
8. Servan-Mori E, Sosa-Rubí SG, Najera-Leon E, Darney BG (2016) Timeliness, frequency and content of antenatal care: Which is most important to reducing indigenous disparities in birth weight in Mexico? Health Policy Plan 31: 444-453.
9. Khanal V, Zhao Y, Sauer K (2014) Role of antenatal care and iron supplementation during pregnancy in preventing low birth weight in Nepal: Comparison of national surveys 2006 and 2011. Arch Public Health 72: 4.
10. Pinzón-Rondón ÁM, Gutiérrez-Pinzon V, Madriñan-Navia H, Amin J, Aguilera-Otalvaro P, et al. (2015) Low birth weight and prenatal care in Colombia: A cross-sectional study. BMC Pregnancy Childbirth 15: 118.
11. Croft TN, Marshall AM, Allen CK, Arnold F, Assaf S, et al. (2018) Guide to DHS statistics. Rockville, MD: ICF.
12. Hosmer DW, Lemeshow S, Sturdivant RX (2013) Applied logistic regression. (3rd edn), John Wiley & Sons.
13. Sabbaghchi M, Jalali R, Mohammadi M (2020) A systematic review and meta-Analysis on the prevalence of low birth weight infants in Iran. J Pregnancy 2020: 3686471.
14. Kandel KP, Kafle S (2017) Risk factors associated with low birth weight among deliveries at bharatpur hospital. J Nepal Health Res Counc 15: 169-173.
15. Oladeinde HB, Oladeinde OB, Omoregie R, Onifade AA (2015) Prevalence and determinants of low birth weight: The situation in a traditional birth home in Benin City, Nigeria. Afr Health Sci 15: 1123-1129.
16. Shen L, Wang J, Duan Y, Yang Z (2021) Prevalence of low birth weight and macrosomia estimates based on heaping adjustment method in China. Sci Rep 11: 15016.
17. Muchemi OM, Echoka E, Makokha A (2015) Factors associated with low birth weight among neonates born at Olkalou District hospital, Central Region, Kenya. Pan Afr Med J 20: 108.
18. Islam MM, Ababneh F, Akter T, Khan HR (2020) Prevalence and risk factors for low birth weight in Jordan and its association with under-five mortality: A population-based analysis. East Mediterr Health J 26: 1273-1284.
19. Katiso NA, Kassa GM, Fekadu GA, Berhe AK, Muche AA (2020) Prevalence and determinants of low birth weight in Ethiopia: A systematic review and meta-analysis. Advances in Public Health 2020: 1-13.
20. Blencowe H, Krasevec J, de Onis M, Black RE, An X, et al. (2019) National, regional, and worldwide estimates of low birthweight in 2015, with trends, from 2000: A systematic analysis. Lancet Glob Health 7: e849-e860.
21. World Health Organization (2010) Accelerating progress towards the health-related millennium development goals.
22. Dowding VM (1981) New assessment of the effects of birth order and socioeconomic status on birth weight. Br Med J (Clin Res Ed) 282: 683-686.
23. Collins JW, Wambach J, David RJ, Rankin KM (2009) Women's lifelong exposure to neighborhood poverty and low birth weight: A population-based study. Matern Child Health J 13: 326-333.
24. Janevic T, Stein CR, Savitz DA, Kaufman JS, Mason SM, et al. (2010) Neighborhood deprivation and adverse birth outcomes among diverse ethnic groups. Ann Epidemiol 20: 445-451.
25. Singh S, Torres A, Forrest JD (1985) The need for prenatal care in the United States: Evidence from the 1980 national natality survey. Fam Plann Perspect 17: 118-124.
26. O'Regan K, Wiseman M (1989) Birth weights and the geography of poverty. FOCUS 12.
27. Restrepo-Méndez MC, Lawlor DA, Horta BL, Matijasevich A, Santos IS, et al. (2015) The association of maternal age with birthweight and gestational age: A cross□cohort comparison. Paediatr Perinat Epidemiol 29: 31-40.
28. Wubetu AD, Amare YE, Haile AB, Degu MW (2021) Newborn birth weight and associated factors among mother-neonate Pairs in public hospitals, North Wollo, Ethiopia. Pediatric Health Med Ther 12: 111-118.
29. Smith GC (2000) Sex, birth weight, and the risk of stillbirth in Scotland, 1980–1996. Am J Epidemiol 151: 614-619.
30. Kader M, Perera NKPP (2014) Socio-economic and nutritional determinants of low birth weight in India. N Am J Med Sci 6: 302-308.
31. 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 Childbirth 15: 222.
32. Agarwal K, Agarwal A, Agrawal V, Agrawal P, Chaudhary V (2011) Prevalence and determinants of "low birth weight" among institutional deliveries. Annals of Nigerian Medicine 5.
33. Bener A, Saleh NM, Salameh KMK, Basha B, Joseph S, et al. (2012) The impact of the interpregnancy interval on birth weight and other pregnancy outcomes. Rev Bras Saúde Matern Infant 12: 233-241.
34. Chakraborty P, Anderson AK (2011) Maternal autonomy and low birth weight in India. J Womens Health 20: 1373-1382.
35. Carlson GJ, Kordas K, Murray-Kolb LE (2015) Associations between women's autonomy and child nutritional status: A review of the literature. Matern Child Nutr 11: 452-482.
36. Sharma A, Kader M (2013) Effect of women's decision-making autonomy on infant's birth weight in rural Bangladesh. ISRN Pediatr 2013: 159542.
37. World Health Organization (1994) Indicators to monitor maternal health goals: Report of a technical working group, Geneva, 8-12 November 1993.