

Determinants of Low birthweight and Preterm Delivery in the Volta Region of Ghana: Evidence from birth records

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Abstract

Background:

Low birthweight and preterm delivery are birth outcomes that can predict the survival, development and long-term health outcomes of newborns. Though advances in medical research have improved birth outcomes these birth outcomes still remain issues of public health concern. This study assessed the determinants of low birthweight and preterm delivery in the Volta region of Ghana.

Methods:

This retrospective cross-sectional study analyzed data from 680 birth records of all deliveries between October and December, 2018 at the Ho Teaching Hospital in the Volta Region of Ghana. Univariate and multivariate logistic regression models were used to predict determinants of low birthweight and preterm delivery using Stata MP/16.0.

Results:

Overall, the prevalence of low birthweight was 12.9% and that of preterm delivery was 14.1%. Increasing maternal age (AOR: 0.52; 95% CI: 0.28-0.98), multiparity (AOR: 0.54; 95% CI: 0.30-0.94) and increasing doses of Sulphadoxine pyrimethamine (AOR: 0.43; 95% CI: 0.22-0.84) significantly reduced the odds of low birthweight. However, delivery through caesarean section (AOR: 1.94; 95% CI: 0.1.16-3.27) and hypertension (AOR: 2.06; 95% CI: 1.27-03.33) significantly increased the likelihood of low birthweight. Increasing number of antenatal care visits (AOR: 0.38; 95% CI: 0.18-0.80) and doses of Sulphadoxine pyrimethamine (AOR: 0.43; 95% CI: 0.19-0.97) were significantly associated with decreased odds of preterm delivery while delivery through caesarean section increased the odds of preterm delivery by 2 folds (AOR: 2.14; 95% CI: 1.15-3.99).

Conclusion:

This study shows maternal age, parity, number of ANC visits, hypertension, SP/IPTp and caesarean section were independent determinants of low birthweight and preterm delivery. These findings add up to literature on the determinants of these adverse birth outcomes particularly in resource-limited environments. Furthermore, this study could serve as a foundation for further research in the study area and for developing public health interventions geared towards reducing the risk and complications of these birth outcomes.

Background

Birthweight is an important variable which influences the survival and development of newborns. It refers to the first weight of a neonate taken in the first few hours of its birth. Therefore, normal birthweight is crucial for neonatal survival, optimal child development and a healthier life in adulthood (1). The World Health Organization (WHO) stipulates that the normal weight of a baby that reaches full term is between

2.7 and 4.1 kilograms with an average weight of 3.5 kilograms. In that regard, the organization defines low birthweight (LBW) as weight at birth of less than 2.5 kilograms (2). This classification was influenced by epidemiological data that newborns who weigh less than 2.5 kilograms are at increased risk of neonatal mortality compared to their counterparts who weigh heavier (3).

Preterm delivery (PTD) is a term used to describe babies born alive before 37 weeks of pregnancy are completed (4). Preterm babies are at a greater risk of neonatal infections and as such may require more complex care resulting in prolonged hospitalizations, increased costs and high mortality (5). According to WHO, the main reason for low birthweight is preterm delivery though its aetiology still remains a mystery. However, some researchers argue morbidities and infections such as malaria, hypertension, syphilis and HIV can cause preterm delivery (6,7). Others argue preterm delivery is caused by multiple aetiologies such as individual and environmental factors which makes its prediction and prevention a difficult process during antenatal care (8,9).

Though advances in medical research have improved birth outcomes (10), these birth outcomes still remain issues of public health concern particularly in low and middle income countries as major contributors to morbidity and mortality during neonatal, infancy and childhood stages (11). Different studies have reported different determinants of low birthweight. For instance, a survey in China identified young maternal age, educational level, a history of adverse pregnancy outcomes and maternal morbidities such as hypertensive disorders and gestational diabetes to be associated with low birthweight (12). Several risk factors have also been reported to influence PTD. These include age, socio-economic status, gestational diabetes, pre-eclampsia and foetal distress (13,14).

In Sub-Saharan Africa, maternal malaria and HIV infections are major determinants of adverse birth outcomes. In Nigeria, a study found that 14.1% of babies born to the HIV positive women had LBW compared to 1.0% in women with no HIV infection (15). A randomized controlled trial in Malawi reported preterm babies were born to 36.4% of women who had malaria compared to 28.5% without malaria (6). With regard to maternal age as a determinant of these birth outcomes, there are inconsistent results. For instance some studies have reported that risk of delivering low birthweight babies among teenage mothers is higher than that of older women (16,17). However, other studies older mothers are more likely to experience these birth outcomes (18,19).

In Ghana, the 2014 Ghana Demographic and Health Survey (GDHS) reported 10% of newborns in Ghana had LBW (20). However, the prevalence of LBW in parts of the country are higher. For instance, a prevalence of 26% was reported in a study in Northern Ghana in 2015 (21) and 21% in Ashanti region in 2013 (22). There is no national data on the prevalence of PTD. That notwithstanding, some studies have been conducted in the country to identify determinants of LBW and PTD. A study in the Greater Accra region found premature rupture of membrane and pre-eclampsia/eclampsia were associated with increased risk of preterm delivery while four or more antenatal care visits was protective (23). A similar study on LBW reported anaemia, preterm delivery, education and not taking iron supplements during pregnancy to be significantly associated with LBW (11).

The Volta region of Ghana is reported to have above average health indicators regarding antenatal care and hospital-based deliveries. This is corroborated by findings from the 2014 GDHS that suggested the region improved health indicators compared to other regions (20). However, the region is known to have one of the highest prevalences of teenage pregnancy which is a known risk factor for LBW and PTD (24). Based on the different proportions of low birthweight reported by previous research and dearth of research on this subject matter in the region, it is important to study the determinants of these birth outcomes in the region.

Adequate knowledge on determinants of these birth outcomes is crucial for identifying them and providing appropriate care and attention to pregnant women at risk. However, in the Volta region, little is known about determinants that predispose a pregnant woman to deliver low birthweight or preterm babies. Consequently, identifying these determinants will considerably contribute to current efforts to address these issues of public health concern which can jeopardize the future of newborns. In that regard, a decline in the incidence of low birthweight and preterm babies will significantly reduce costs associated with catering for such babies, lessen the burden on the health system and reduce the occurrence of neonatal and childhood morbidity and mortality in the region and the country as a whole. This study assessed the determinants of low birthweight and preterm delivery in the Volta region of Ghana.

Methods

Study site and design

We conducted a retrospective cross-sectional study at the Ho Teaching Hospital (HTH) in the Volta region of Ghana which serves as the major referral hospital in the region. The hospital was established in December, 2000 and was upgraded to a teaching hospital in April, 2019. HTH is located in the Ho Municipality, one of the 17 districts in the Volta region. The Ho Municipality has a total land area of 2,361 square kilometers. The Municipality has about 49 health facilities that provide health services to Municipality population of 177,281. The 300-bed capacity hospital is strategically located to render specialised health services to indigenes of the Volta region and beyond. The hospital is also patronized by clients from the Republics of Togo and Benin as well as the Federal Republic of Nigeria. The HTH has approximately 103,964 annual Outpatient attendance and provides about forty-one (41) essential services including maternal and child health services. Pregnancy-related complications, anaemia and malaria remain the top three causes of all hospital admissions (25). Professionally trained nurses and midwives at the maternity unit of the HTH record pregnancy and birth outcome information of expectant mothers as well as demographic information of these mothers in delivery registers. This study examined birth records of all mothers who delivered live babies at the HTH between October and December, 2018 to identify determinants of low birthweight and preterm delivery.

Data Extraction And Sample Size

A pre-tested data extraction sheet was used to extract data about maternal and newborn characteristics from delivery registers. Four trained midwives extracted the data from the registers. These midwives were oriented on the eligibility criteria for inclusion into the study as well as the data extraction process. Data collection was supervised daily to ensure consistency, completeness and accuracy of the extracted data. All live births within the study period were considered for this study. However, analysis was conducted on 680 birth records after stillbirths, multiple births, babies born with congenital abnormalities and birth records with missing information were excluded. Birth records of babies born with congenital abnormalities and multiple births were excluded based on the assumption that they had different risk and aetiology for low birthweight and preterm delivery. Stillbirths were also excluded because they were few and majority had missing information on birth weight and gestational age.

Study Variables

The outcome variables of this study were low birthweight and preterm delivery. Birthweight was dichotomized as a binary variable; 0 “normal weight” when birthweight ≥ 2.5 kilograms and 1 “LBW” when birthweight was < 2.5 kilograms. Similarly, gestational age was also dichotomized into: 0 “carried to term” when gestational age at delivery was ≥ 37 weeks and “PTD” when gestational age at delivery was < 36 weeks.

Explanatory variables included maternal socio-demographic information such as age categorized based on that of (20), educational level, occupation, marital status), religion and ethnicity. Obstetric characteristics such as parity (0 = nulliparous, 1 = primiparous, 2–4 = multiparous and ≥ 5 = grand multiparous), gravidity (1 = primigravida and ≥ 2 = multigravida), type of delivery, intake of Sulphadoxine pyrimethamine (SP) for Intermittent Preventive Treatment of malaria in pregnancy (IPTp) and number of Antenatal care (ANC) visits (< 4 visits, 4 visits and > 4 visits) were also extracted. Additionally, maternal health conditions such as malaria, Hepatitis B and syphilis infections as well as sickling status were captured. Haemoglobin level of mothers was dichotomized into normal (≥ 11.0 g/dl) and anaemic (< 11.0 g/dl) based on WHO cut-offs (26).

Data Management And Analysis

The data extraction sheets were checked for accuracy and completeness before passed on for data entry. Data entry was done using EpiData Data Entry Client (v4.4.3.1) and then exported to STATA MP/16.0 (College Station, Texas, USA) for analysis. Descriptive statistics was used for frequencies. Percentages were reported for categorical variables. Means and standard deviations were also determined for continuous variables. Univariate and multivariate logistic regression analyses were performed for outcome variables. Strengths of associations between outcome variables and explanatory variables were determined using crude odds ratios. Explanatory variables with p-values < 0.05 in the univariate analysis were considered for a stepwise multivariate logistic regression model. Adjusted odds ratios and their confidence intervals were then computed with p-values < 0.05 considered as statistically significant.

Results

Socio-demographic characteristics of women who delivered

Six hundred and eighty (680) women were involved in this study with a mean age of 27.5 ± 6.18 . Women aged 20–34 years formed the majority of the participants. Few women 96(14.1%) had no formal education while the remaining 85.9% had varying forms of education ranging from primary school 82(12.1%) to tertiary education 116(17.1%). More 431(63.4%) women were employed in the private sector and more than half 445(65.4%) were married. The dominant religion was Christianity 603(88.7%) while Ewe was the dominant tribe (Table 1).

Table 1
Socio-demographic characteristics of women who delivered

Characteristic	Frequency [N = 680]	Percentage (%)
Age (years)		
< 20	79	11.6
20–34	494	72.7
35–49	107	15.7
Educational level		
No formal education	96	14.1
Primary School	82	12.0
JSS/JHS/Middle School	239	35.2
SHS/SSS/Vocational	147	21.6
Tertiary	116	17.1
Occupation		
Unemployed	146	21.5
Private sector	431	63.4
Public sector	103	15.1
Marital status		
Single	235	34.6
Married	445	65.4
Religion		
Christianity	603	88.7
Islam	48	7.0
African traditional religion	29	4.3
Tribe		
Ewe	484	71.2
Akan	65	9.6
Guan	58	8.5
Others	73	10.7

Maternal obstetric characteristics of women who delivered

Maternal obstetric information is summarized in Table 2. Majority of the women were multiparous 238(35.0%) and multigravida 504(74.1%). A little more than a third 238(35.0%) of the women had taken 3 doses of SP while 218(32.9%) had taken more than three doses of SP. More than half 519(76.3%) had more than 4 ANC visits. Based on infectious diseases, 30(4.4%) had Hepatitis B infection, 6(0.9%) had syphilis and 135(19.9%) had malaria. Less than half 102(15%) had hypertension while 390(57.4%) had anaemia.

Table 2
Obstetric characteristics of women who delivered

Characteristic	Frequency [N = 680]	Percentage (%)
Parity		
Nulliparous	225	33.1
Primiparous	191	28.1
Multiparous	238	35.0
Grand multiparous	26	3.8
Gravidity		
Primigravida	176	25.9
Multigravida	504	74.1
Delivery type		
Normal/vaginal	538	79.1
Caesarean section	140	20.6
Vacuum extraction	2	0.3
SP/IPTp dosage		
< 3	218	32.1
3	238	35.0
> 3	224	32.9
ANC visits		
< 4	80	11.8
4	81	11.9
> 4	519	76.3
Hepatitis B infection		
Negative	650	95.6
Positive	30	4.4
Syphilis infection		
Negative	674	99.1
Positive	6	0.9

Characteristic	Frequency [N = 680]	Percentage (%)
Hypertension status		
Normotensive	578	85.0
Hypertensive	102	15.0
Anaemia status		
Normal	290	42.6
Anaemic	390	57.4
Sickling status		
Negative	563	82.8
Positive	117	17.2
Malaria infection		
Negative	545	80.1
Positive	135	19.9
Obstetric complications		
Absent	657	96.6
Present	23	3.4

Prevalence Of Low Birthweight And Preterm Delivery

Out of the 680 women included in this study, the prevalence of LBW was 12.9% [95% CI: 10.5% -15.7%] while that of PTD was 14.1% [95% CI: 11.9% -17.3%].

Determinants of Low birthweight

Multivariate logistic regression was used to predict the determinants of LBW (Table 3). In the adjusted analysis, women aged 20–34 years had 48% lower odds of delivering LBW babies (AOR: 0.52; 95% CI: 0.28–0.98; $p < 0.05$) compared to those less than 20 years. Additionally, multiparous women had 46% lower odds of having LBW babies (AOR: 0.54; 95% CI: 0.30–0.94; $p < 0.05$) compared to their nulliparous counterparts. Women who delivered through caesarean section (CS) were 94% more likely to have LBW babies (AOR: 1.94; 95% CI: 0.1.16–3.27; $p < 0.05$) compared to those who had vaginal deliveries. Furthermore, women who had taken more than 3 doses of SP for IPTp had 57% lower odds of giving birth to LBW babies compared to those who took less than 3 doses of SP (AOR: 0.43; 95% CI: 0.22–0.84; $p <$

0.05). Hypertensive women were 2 times more likely to have low birthweight babies as compared to normotensive women (AOR: 2.06; 95% CI: 1.27–3.33; $p < 0.05$).

Table 3

Association between Socio-Demographic, Obstetric characteristics, maternal health conditions and the odds of Low birthweight

Characteristic	Low birthweight [N = 88] n (%)	COR (95% CI) p-value	AOR (95% CI) p-value
Age (years)			
< 20	17(19.3)	Ref.	Ref.
20–34	56(63.6)	0.47(0.25, 0.85) 0.013	0.52(0.28, 0.98) 0.043
35–49	15(17.1)	0.59(0.27, 1.28) 0.183	0.65(0.29, 1.43) 0.286
Educational level			
No formal education	12(13.6)	Ref.	
Primary School	14(15.9)	1.44(0.63,3.32) 0.391	
JSS/JHS/Middle School	31(35.2)	1.04(0.51, 2.13) 0.907	
SHS/SSS/Vocational	21(23.9)	1.17(0.54, 2.50) 0.691	
Tertiary	10(11.4)	0.66(0.27, 1.60) 0.359	
Occupation			
Unemployed	21(23.9)	Ref.	
Private sector	58(65.9)	0.92(0.54, 1.59) 0.778	
Public sector	9(10.2)	0.57(0.24, 1.30) 0.182	
Marital status			
Single	41(46.6)	Ref.	
Married	47(53.4)	0.56(0.36, 8.88) 0.012	
Parity			
Nulliparous	38(43.2)	Ref.	Ref.
Primiparous	24(27.3)	0.71(0.41, 1.23) 0.219	0.74(0.42, 1.29) 0.291
Multiparous	22(25.0)	0.50(0.29, 0.88) 0.016	0.54(0.30, 0.94) 0.031
Grand multiparous	4(5.5)	0.89(0.29, 2.74) 0.846	0.84(0.23, 2.55) 0.757
Gravidity			
Primigravida	28(31.8)	Ref.	

Characteristic	Low birthweight [N = 88] n (%)	COR (95% CI) p-value	AOR (95% CI) p-value
Multigravida	60(68.2)	0.71(0.43, 1.16) 0.174	
Delivery type			
Normal/vaginal	62(70.4)	Ref.	Ref.
Caesarean section	26(29.6)	1.76(1.07, 2.90) 0.025	1.94(1.16, 3.27) 0.012
Vacuum extraction	0(0.0)	1.52(0.07, 3.21) 0.786	1.96(0.09, 4.20) 0.666
SP/IPTp dosage			
< 3 doses	40(45.4)	Ref.	Ref.
3 doses	32(36.4)	0.69(0.42, 1.15) 0.153	0.91(0.52, 1.60) 0.739
> 3 doses	16(18.2)	0.34(0.18, 0.63) 0.001	0.43(0.22, 0.84) 0.013
ANC visits			
< 4 visits	12(13.6)	Ref.	
4 visits	16(18.2)	1.39(0.61, 3.17) 0.428	
> 4 visits	60(68.2)	0.74(0.38, 1.45) 0.380	
Hepatitis B infection			
Negative	81(92.1)	Ref.	
Positive	7(7.9)	2.13(0.89, 5.14) 0.090	
Syphilis infection			
Negative	85(96.6)	Ref.	
Positive	3(3.4)	6.93(1.38, 34.89) 0.019	
Hypertension status			
Normotensive	53(60.2)	Ref.	Ref.
Hypertensive	35(39.8)	1.98(1.24, 3.16) 0.004	2.06(1.27, 3.33) 0.003
Anaemia status			
Normal	35(39.8)	Ref.	
Anaemic	53(60.2)	1.28(0.81, 2.03) 0.278	
Sickling status			

Characteristic	Low birthweight [N = 88] n (%)	COR (95% CI) p-value	AOR (95% CI) p-value
Negative	70(79.5)	Ref.	
Positive	18(20.5)	1.28(0.73, 2.24) 0.388	
Malaria infection			
Negative	60(68.2)	Ref.	Ref.
Positive	28(31.8)	2.11(1.28, 3.47) 0.003	1.50(0.86, 2.64) 0.156

Determinants of Preterm delivery

Table 4 summarizes the determinants of preterm delivery. Women who had caesarean section were 2 times more likely to have PTD compared to those with vaginal delivery (AOR: 2.14; 95% CI: 1.15–3.99; $p < 0.05$). However, women with more than 4 ANC visits were 62% less likely to experience PTD (AOR: 0.38; 95% CI: 0.18–0.80; $p < 0.05$) compared to those with less than 4 visits. Furthermore, women who took more than three doses of SP were also 57% less likely to have preterm delivery compared to those with less than three doses (AOR: 0.43; 95% CI: 0.19–0.97; $p < 0.05$).

Table 4

Association between Socio-Demographic Obstetric characteristics, maternal health conditions and the odds of Preterm delivery

Characteristic	Preterm delivery [N = 96] n (%)	COR (95% CI) p-value	AOR (95% CI) p-value
Age (years)			
< 20	21(21.9)	Ref.	Ref.
20–34	60(62.5)	0.38(0.22, 0.67) 0.001	0.63(0.30, 1.33) 0.231
35–49	15(15.6)	0.45(0.21, 0.94) 0.034	0.88(0.35, 2.21) 0.791
Educational level			
No formal education	21(21.9)	Ref.	
Primary School	11(11.5)	0.55(0.25, 1.23) 0.146	
JSS/JHS/Middle School	34(35.4)	0.59(0.32, 1.08) 0.090	
SHS/SSS/Vocational	18(18.8)	0.50(0.25, 0.99) 0.048	
Tertiary	12(12.5)	0.41(0.19, 0.89) 0.024	
Occupation			
Unemployed	25(26.0)	Ref.	
Private sector	60(62.5)	0.78(0.47, 1.30) 0.346	
Public sector	11(11.5)	0.58(0.27, 1.24) 0.158	
Marital status			
Single	46(47.9)	Ref.	
Married	50(52.1)	0.52(0.34, 0.80) 0.003	
Parity			
Primiparous	38(39.6)	Ref.	
Multiparous	58(60.4)	0.72(0.46, 1.12) 0.146	
Gravidity			
Nulliparous	38(39.6)	Ref.	
Primiparous	22(22.9)	0.64(0.36, 1.13) 0.122	
Multiparous	29(30.2)	0.68(0.40, 1.15) 0.152	

Characteristic	Preterm delivery [N = 96] n (%)	COR (95% CI) p-value	AOR (95% CI) p-value
Grand multiparous	7(7.3)	1.81(0.71, 4.61) 0.212	
Delivery type			
Normal/vaginal	69(71.9)	Ref.	Ref.
Caesarean section	27(28.1)	1.63(1.01,2.66) 0.047	2.14(1.15, 3.99) 0.016
Vacuum extraction	0(0.0)	1.35(0.06, 2.84) 0.847	2.40(0.11, 5.24) 0.578
SP/IPTp dosage			
< 3 doses	52(54.2)	Ref.	Ref.
3 doses	30(31.2)	0.46(0.28, 0.75) 0.002	0.77(0.41, 1.45) 0.422
> 3 doses	14(14.6)	0.21(0.11, 0.40) < 0.001	0.43(0.19, 0.97) 0.041
ANC visits			
< 4 visits	23(24.0)	Ref.	Ref.
4 visits	22(22.9)	0.92(0.46, 1.84) 0.822	0.87(0.38, 2.01) 0.750
> 4 visits	51(53.1)	0.27(0.15, 0.47) < 0.001	0.38(0.18, 0.80) 0.010
Hepatitis B infection			
Negative	92(95.8)	Ref.	
Positive	4(4.2)	0.93(0.31, 2.74) 0.900	
Syphilis infection			
Negative	94(97.9)	Ref.	
Positive	2(2.1)	3.08(0.56, 17.08) 0.197	
Hypertension status			
Normotensive	83(86.5)	Ref.	
Hypertensive	13(13.5)	0.94(0.58, 1.55) 0.836	
Anaemia status			
Normal	37(38.5)	Ref.	Ref.
Anaemic	59(61.5)	2.27(1.27, 4.03) 0.005	1.69(0.92, 3.10) 0.092
Sickling status			

Characteristic	Preterm delivery [N = 96] n (%)	COR (95% CI) p-value	AOR (95% CI) p-value
Negative	77(80.2)	Ref.	
Positive	19(19.8)	1.22(0.71, 2.11)	0.469
Malaria infection			
Negative	61(63.5)	Ref.	
Positive	35(36.5)	2.78(1.73, 4.43)	< 0.001

Discussion

This study sought to identify the determinants of LBW and PTD among women in the Volta Region of Ghana. Overall, the study found the prevalence of LBW to be 12.9%. This proportion is higher than the 10% national prevalence which was reported in the 2014 by GDHS. The reported prevalence in this study is also higher than the 6% recorded for the Volta region in the same 2014 by DHS (20). The prevalence of LBW in this study is also higher than what was reported in the United Arab Emirates. That study reported a prevalence of 9.4% (27). This could be attributed to geographical differences in study sites.

This study found that women aged 20–34 years were less likely to have LBW babies compared to those aged less than 20 years. This is consistent with data published by Althabe and colleagues, Alemu, and Taha and friends. These studies reported teenage mothers have an increased risk of delivering LBW babies compared to older women (16,17,27). However, this finding was inconsistent with those found by (19) and (18) who reported older women have an increased risk of LBW as compared to younger women. These results still point to the fact that inconsistent results still exist about maternal age and adverse birth outcomes, particularly LBW. Teenage mothers are most likely to be first timers with little or no experience with management of pregnancies. This could be a contributory factor to why women aged 20–34 years had less odds of LBW compared to teenage mothers in this study. Additionally, teenage mothers may not be physically and emotionally mature. Thus, their bodies may be unable to deal with the stress of pregnancy (24). Coupled with this, good maternal nutrition, socio-economic status and adequate ANC attendance could have made the 20-34-year-old women less likely to experience LBW.

Low birthweight babies were less likely to be born to multiparous women. This is consistent with a recent study conducted in India that reported that increased parity of a mother increased the mean birthweight of babies (28). Similarly, another study in Bangladesh also found that increasing parity increases birthweight leading to reduction in the occurrence of LBW (29). A plausible explanation for this observation might be that increased parity might lead to increased experience with pregnancy and childcare, ANC attendance, nutritional status and health seeking behaviour. However, this finding was incongruent with a similar study conducted in the Brong-Ahafo region of Ghana. That literature suggested

that increasing parity significantly increased the odds of low birthweight (30). Another study in Ethiopia reported similar findings to those of Mohammed and colleagues (31).

In this study, the odds of delivering a LBW baby was significantly high among women who delivered their babies through CS compared to those with vaginal deliveries. This finding resonates with a studies conducted in the United Arab Emirates (27) and China (32). Some studies have reported an epidemic of CS which these studies have found to increase adverse birth outcomes such as LBW and preterm delivery (33,34). A plausible explanation for this finding in this study could be attributed to the abuse of planned CS. A phenomenon which has been documented in an earlier study in Brazil where it was reported that CS was wrongfully associated with LBW particularly among private hospitals (35). In that regard, there is the need to adhere to WHO's recommendations that CS birth should not be planned before 39 completed weeks of gestation unless it is medically indicated for the benefit of either the foetus or mother or both (36). There are inconsistent results regarding the association between LBW and CS. This is because some studies have reported that CS is protective against low birth weight (37,38) while others have shown that it increases the likelihood of LBW (39) which is similar to the current findings.

The WHO recommends pregnant women take three or more doses of Sulphadoxine Pyrimethamine for intermittent prevention of malaria in pregnancy (SP/IPTp) in moderate to high malaria transmission areas (40). We found that more than 3 doses of SP/IPTp significantly reduced the odds of LBW. This is in conformity with several studies conducted in Tanzania (41,42), Cameroon (43), Nigeria (44) and Ghana (45). The protective nature of SP against LBW could be explained by its therapeutic effect against both malaria and non-malaria infections. This is supported by evidence from a Zambian study which reported that the bacterial and parasitic effects of SP significantly improved the birthweight of neonates born to women who took more doses of SP during pregnancy. The Sulphadoxine component of SP provides a broad spectrum of anti-parasitic and bacterial activities (46). Thus, constant exposure via monthly update of SP could reduce microbial density and immunological reactions leading to adverse birth outcomes such as LBW (46–48).

Our findings further indicate that the likelihood of LBW was significantly higher among hypertensive women compared to their normotensive counterparts. This is consistent with literature in China (49), Ethiopia (50), Brazil (51) and Haiti (52). Some studies have linked the association between pregnancy induced hypertension and LBW to intrauterine growth restriction as a result of the placenta not receiving enough nutrients. This occurs as a result of poor perfusion of blood containing nutrients via the placenta. The placenta provides blood and essential nutrients from the mother to the foetus for optimal growth and development (50). Thus, pregnancy induced hypertension increases the risk of poor foetal nutrition hence poor foetal growth leading to LBW (49,53).

The current study also identified determinants of PTD and found that women who took more than three doses of SP had reduced odds of having preterm birth. This resonates with data published in an earlier study in Northern Ghana where it was reported that high uptake was significantly associated with delivery at term (54). The uptake of more doses of SP is known to reduce prevalence and intensity of placenta

malaria as well as placenta parasitemia which are significant risk factors for preterm delivery (44,55,56). This finding provides useful information on the effectiveness of SP particularly in malaria endemic settings. Additionally, some researchers have reported that SP may have some secondary effects on bacterial and fungal infections which promotes maternal and foetal health thereby reducing the occurrence of preterm delivery (57–59).

The importance of Antenatal care in the prevention, detection and treatment of pregnancy-related conditions cannot be underestimated. With this, WHO recommends all pregnant women go for their first ANC visits in the first trimester of their pregnancy. This recommendation will allow for early diagnosis and management of health conditions as well as identifying risk factors which can negatively affect the progress and outcomes of pregnancy (60). Our study found that women with more than four ANC visits had reduced odds of delivering preterm. In Ghana, ANC services assessed by pregnant women are in consonance with WHO's recommendations including counselling on healthy diet and good nutrition, tobacco and substance use and physical activity, HIV and malaria prevention, tetanus vaccination, foetal measurements and advice for dealing with physiological pregnancy symptoms such as nausea, back pain and constipation (60). This comprehensive ANC package could have helped identify high risk pregnancies among the women with more ANC visits. Subsequently, measures would have been put in place to reduce these high-risk pregnancies and thus the lower risk of preterm delivery. This assertion is corroborated by different studies by Turienzo and Cunningham who emphasized on how the content and type of ANC packages help reduce adverse birth outcomes (61,62).

We found that babies born through caesarean section were twice as likely to be born preterm compared to those born through vaginal delivery. One plausible explanation for this could be that preterm babies were delivered through CS due to foetal compromises such as foetal distress (63). It could also mean that the CS was planned due to history of previous CS or as a result of pregnancy induced hypertension. There are inconsistent results on the impact of CS on preterm delivery. This is because, some earlier studies reported CS improves the outcomes of preterm babies (64,65), while others suggest vaginal birth is protective against preterm delivery (66).

A major limitation to this study is that, data collected for routine healthcare services and not primarily for research was used for analysis. With this, there is possibility of errors occurring during documentation. However, routine healthcare services data can be used for planning, monitoring and evaluation of public health interventions.

Conclusion

Evidence from this study indicates that maternal age, parity, number of ANC visits, hypertension, SP/IPTp and caesarean section were independent determinants of LBW and PTD. These findings add up to literature on the determinants of these adverse birth outcomes particularly in resource-limited environments. Furthermore, this study could serve as a foundation for further research in the study area

and for developing public health interventions geared towards reducing the risk and complications of these birth outcomes.

List Of Abbreviations

WHO- World Health Organization; LBW- Low birthweight; PTD- Preterm delivery; GDHS- Ghana Demographic and Health Survey; GHS- Ghana Health Service; UHAS- University of Health and Allied Sciences; VRHD- Volta Regional Health Directorate; REC- Research Ethics Committee; UHAS-REC- University of Health and Allied Sciences Research Ethics Committee; HTH- Ho Teaching Hospital; SP- Sulphadoxine Pyrimethamine; SP/IPTp- Sulphadoxine pyrimethamine for Intermittent Preventive Treatment of malaria in pregnancy; ANC- Antenatal care; CS- Caesarean Section.

Declarations

Ethical approval and consent to participate

Ethical approval for this study was obtained from the Research Ethics Committee (REC) of the University of Health and Allied Sciences (UHAS) with the help of the School of Public Health of the university. The ethical clearance number of this study was UHAS-REC A. [6] 18-19. The study only began after ethical approval had been given by the REC. Permission was also sought from the Volta Regional Health Directorate (VRHD) and the medical director of HTH. This study involved the extraction of secondary data and thus no informed consent was used in this study. The information obtained from this study was kept confidential. Personal information and information on personal practices were anonymized during data analysis and dissemination findings from the study. Data management, storage, analysis and reporting was done using codes which could not expose the details of participants. Information about participants was also stored in a file with a code. This file was accessible only to the investigator.

Consent for publication

Not applicable

Availability of data and materials

All data and materials are available upon reasonable request from the corresponding author.

Competing interests

The authors declare no competing interests.

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Authors' contributions

WKA, FNB and MK conceived the study. WKA, FNB and MK did the data analysis and wrote the methods section. WKA, FNB, and MK, were responsible for the initial draft of the manuscript. All authors reviewed and approved the final version of the manuscript.

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Figures

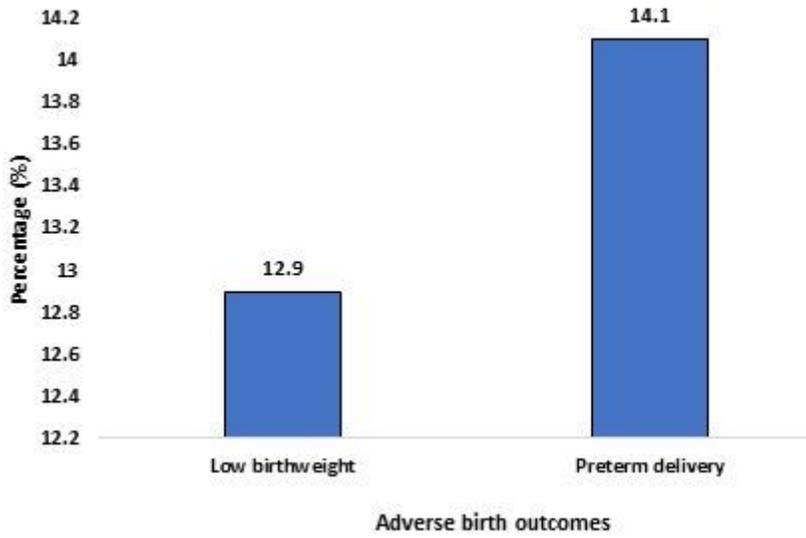


Figure 1

Prevalence of low birthweight and preterm delivery