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RESEARCH ARTICLE

Trends and Risk Factors for Low-Birth Weight and Preterm Deliveries between 2018–2022 in a PHC Setting of South Africa

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ABSTRACT

Background: **Negative birth outcomes such as low birthweight (LBW) and preterm births (PTB) are public health concerns that require an understanding of the magnitude and risk factors for intervention.**

Objective: **The objectives were to characterize the patterns of maternal demographics and antenatal care (ANC) variables that may be connected to PTB and LBW.**

Materials and Method: **A retrospective cohort study focused on all pregnant women who gave livebirths of singleton babies at Kwadebeka Community Health Centre between January 2018 and December 2022. Data was collected from the birth registration. Cases were categorized as either having or not having PTB, LBW, and both PTB and LBW babies. Each dependent variable of interest was subjected to an independent model. Adjusted odds ratios (OR), matching two-sided 95% confidence intervals (CI), and related p-values were used to express the outcomes of regression models. A p-value of less than 0.05 was deemed significant.**

Results: **A total of 4116 women were registered in the birth register, 48 of whom had stillbirths and delivered multiple babies, and they were excluded from the analysis; thus, 4057 women were the study's sample. Overall, 8.4%, 15.7%, and 5.6% of women had LBW, PTB, and both LBW and PTB, respectively, showing no annual trend. Logistic regression for PTB showed that ANC at KCHC had a higher OR = 1.4 (95% CI:1.1-1.8, p = 0.004), having no ANC OR = 9.3 (95% CI:3.94-22.22, p < 0.001) and number of ANC visits between 1–3 had OR = 3.85 (95% CI:2.42–6.13, p < 0.001) respectively. On the other hand, having no BBA and no LBW had lower ORs of 0.47 (95% CI:0.28-0.79, p = 0.004) and 0.11 (95% CI:0.08-0.16, p < 0.001) respectively. Variables showed lower ORs of 0.38 (95% CI:0.22-0.67, p < 0.001), 0.33 (95% CI:0.13-0.63, p = 0.002), 0.11 (95% CI:0.08-0.16, p < 0.001) and 0.69 (95% CI:0.49-0.97, p = 0.037) for not having BBA, not having syphilis, not having PTB and having ANC at KCHC respectively for LBW babies. On the contrary, having no ANC (0 visits) showed a higher OR of 2.90 (95% CL:1.24-6.78, p = 0.014).**

Conclusion: **PTB and LBW continue to be common problems at some of the PHC facilities, particularly among those women who do not attend ANC, have low numbers of ANC visits, attend late for ANC, have BBAs, and have syphilis infection. Several types of programs, such as specific medical procedures to broad-scale public health interventions such as screening for risk factors, socioeconomic insufficiencies, and educational programmes should be undertaken simultaneously.**

Keywords: Antenatal care, CHC, midwife obstetric unit, primary healthcare.

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1. Introduction

Low birth weight (LBW) kids, defined as deliveries of babies weighing up to and including 2499 g (or 2.49 kg) regardless of gestational age, and preterm babies (PTB), defined as babies born alive before 37 weeks of pregnancy, account for the bulk of neonatal mortality worldwide [1]–[4]. An estimated 13.4 million babies were born preterm (PTB), and 19.8 million babies were born with LBW in 2020 [1], [5]. Learning deficits, as well as visual and auditory issues, are among the lifetime disabilities that many PTB and LBW baby survivors must deal with. Furthermore, with around 900,000 deaths in 2019, PTB complications rank as the primary cause of death for children under the age of five [2]. Of the 134,767,000 births worldwide in 2020, 55·5% of live births occurred in southern Asia (26.8%) and sub-Saharan Africa (28.7%); yet these two regions were responsible for around 65% of all preterm births worldwide, making PTB a truly global health issue [1]. The survival rate of preterm newborns, or PTBs, varies significantly based on their place of birth. For instance, less than 10% of extremely preterm kids in high-income nations pass away in the first few days of life, whereas over 90% of extremely preterm babies (less than 28 weeks) born in low-income countries do so [6]. Current, cost-effective therapies are thought to be able to avert three-quarters of these deaths [1]. PTB rates vary by nation, ranging from 4% to 16% of infants born in 2020 [1]. There are clear disparities in survival rates across the globe. For instance, in low-income environments, half of the babies delivered at or before 32 weeks pass away from a lack of practical, affordable care, such as warmth, assistance with nursing, and basic treatment for infections and respiratory issues. Conversely, practically all of these babies survive in high-income nations. The burden of disability among preterm infants who survive the newborn period is rising as a result of suboptimal use of technology in low- and middle-income environments [1]. There are several causes of preterm birth. The majority of preterm births occur naturally; however, some are caused by illnesses, including infections, repeated pregnancies, chronic diseases like diabetes and high blood pressure, or even genetic factors [6].

According to estimates, between 15% and 20% of all births worldwide each year are LBW babies born in low- and middle-income (LMIC) nations, which bear a disproportionately high burden of LBW (more than 95% of all LBW infants worldwide) [7]. Global and regional differences in LBW rates are significant. According to estimates, up to 28% of babies are born LBW in South Asia, 13% in Sub-Saharan Africa, and 6% in East Asia and the Pacific [7]. A wide range of obstetric risk factors, including hypertension, gestational diabetes, tuberculosis, and sexually transmitted infections (HIV/AIDS and syphilis), can cause adverse pregnancy outcomes in sub-Saharan Africa, including spontaneous abortion, PTB, LBW, intrauterine growth retardation (IUGR), small for gestational age babies, stillbirths, and babies with congenital anomalies [8], [9]. The prevalence of unfavourable birth outcomes can also be influenced by variables such as poverty, maternal malnutrition, bad living situations (such as poor hygienic conditions and ambient air pollution), and exposure to tobacco smoke [8], [9].

There are roughly 70 neonatal fatalities for every 1000 live births and 180 maternal deaths for every 100,000 live births in the KwaZulu-Natal (KZN) province [10]. Numerous diseases affect South African women, including those brought on by the high rates of HIV and tuberculosis (TB), low socioeconomic position, and limited access to healthcare [9], [11]–[13]. According to estimates, there are 1094 instances of TB per 100,000 people in KZN. 12.9% of the general population has the disease, and 37.2% of pregnant women in the province have HIV [14], [15]. According to a hospital-based study, 13.5% of babies were born LBW, and more than 16.4% of moms gave birth to PTB [16]. PTB risk variables were moms over 30 years, current smokers, and caesarean deliveries; mothers who underwent caesarean deliveries were more likely to give birth to LBW kids than mothers who gave birth vaginally [16]. A population-based registry of pregnant women and their babies in rural communities across six low- and middle-income countries (Kenya, Democratic Republic of Congo, Guatemala, Zambia, Pakistan, and India) found that the risk factors for preterm birth, LBW, and the combination were similar across sites. Nulliparity, maternal age <20 years, severe antenatal haemorrhage, hypertensive disorders, and one to three prenatal visits rather than four or more were among these risk factors [17].

Although there is evidence linking socioeconomic factors like maternal education and household income to low birthweight outcomes, few studies in low socioeconomic communities have reported specific household and environmental factors (housing type, biomass exposure, and environmental tobacco smoke). These variables are coupled with a high frequency of known factors such as low nutritional status, poor obstetric history, and positive status for syphilis and HIV. PTB is the primary cause of neonatal fatalities and the second highest cause of mortality for children under five worldwide, making preterm birth a serious public health concern [18]. Growth retardation, malnutrition, and later physical and cognitive development are all strongly predicted by adverse birth outcomes, such as PTB and LBW [19], [20]. With a target of bringing neonatal mortality down to at least 12 per 1,000 live births and under-five mortality down to at least 25 per 1,000 live births, the Sustainable Development Goals (SDGs) aim to reduce avoidable deaths in newborns and children under five by 2030 [21]. The burden of avoidable under-five mortality can be directly decreased by creating and putting into action proactive policies and initiatives to control and lower the prevalence of PTB and LBW [22]. However, it can also greatly improve human development in general and the stock of human capital in particular [23]. Therefore, from the standpoint of public health as well as the calibre of any country's future human capital, addressing these unfavourable birth outcomes continues to be a critical policy problem. Being able to take these important risk factors into consideration in a sample of participants with low socioeconomic status—particularly those from the sub-Saharan subcontinent—is necessary to comprehend these hazards. The aim of this study was to characterize the trends in maternal demographics and antenatal care (ANC) characteristics that might be related to PTB and LBW in a Durban PHC setting.

2. Materials and Method

2.1. *Study Design, Sample Selection and Data Collection*

A retrospective cohort study focused on all pregnant women who gave birth to a singleton child at the Kwadebeka Community Health Centre (KCHC) maternity unit between January 2018 and December 2022. Data was collected from the delivery registration (sometimes called the birth registry) of the labour ward during June and December 2023 for each expectant woman who gave birth. This register formally records all KCHC deliveries as well as infants born before arrival (BBA). The register contained minimum factors related to the personal socioeconomic information of pregnant women, specific ANC care, obstetric data as exposure, and PTB, LBW and common LBW and PTB as outcome variables. The following variables were included in this study as exposure or dependent variables: age, parity, gestational age (GA) at delivery to determine PTB, ANC location (facility), number of ANC visits, ANC booking prior to 20 weeks of GA, baby born before arrival (BBA), HIV and syphilis infections status and targeted polymerase chain reaction (PCR) test result for live birth of HIV-infected mothers. The GA was determined by the midwife using the date of the last mistral period (LMP), in the absence of LMP, where early ultrasound data were available and or the fundal height with corresponding GA was estimated. Data from the pregnancy record was entered into the Microsoft Excel program using a variety of codes.

2.2. *Setting and Population*

Kwadebeka and Clermont's inhabitants use KCHC as a PHC, and it has more than 150,000 Black citizens. These communities are found in the KwaZulu-Natal (KZN) region, which is home to the biggest port in South Africa, inside the limits of Durban Municipality. PHC service packages that provide prenatal and postnatal care without delivery services are available at seven additional permanent PHC clinics in the area that are operated by KCHC. KCHC provides delivery services to expectant mothers from certain clinics. The majority of residents in Kwadebeka and Clermont are unemployed and poor and mostly rely on KCHC's public health services as their first port of call for maternity care and other medical treatment. The rural residents of the Eastern Cape and KZN provinces share a shared culture with these people. At KCHC, the Midwife Obstetric Unit (MOU) is manned by certified midwives and offers maternity services around the clock. ANC, managing labour and delivery services and postnatal checkups for low-risk pregnant women, treating common pregnancy issues, providing ANC for low- and intermediate-risk women, managing emergencies during antenatal and delivery services, and referring patients to the appropriate hospitals (requiring level-one care to a designated district hospital and level two care to a regional hospital) are among the main duties of this unit, as per national guidelines [24]. According to the clinic's unpublished data, there are over 5,000 ANC, birth, and postnatal headcounts annually. Every year, the antenatal clinic sees an estimated 1500 pregnant women and 700 deliveries. Three midwives are assigned to perform births and care for mothers and newborns during the day (7 am to 4 pm), and two midwives are assigned to work after hours (4 pm to 7 am) on weekends and public holidays, in addition to extra support staff. The national protocol and guidelines, which have been in effect since 2016, are followed by KCHC when providing prenatal care and delivery services [25]. This study does not address high-risk pregnancy problems that are identified during ANC since they are sent to hospitals.

2.3. *Care During ANC and Delivery for Mothers and Neonates*

When a pregnant lady comes to KCHC for ANC, a proper history taking, examination, and evaluation are done to diagnose or classify any medical, obstetric, or foetal issues. In KCHC and South Africa, screening tests for anaemia, syphilis, HIV, and rhesus (Rh) blood grouping are regularly conducted during ANC visits. All pregnant women are offered voluntary HIV testing and counselling for inclusion in the universal antiretroviral treatment (ART) program (lifelong ART regardless of gestation, CD4 count, viral load (VL) or clinical stage) on the same day of the test, provided there are no contraindications (such as hepatitis, tuberculosis, etc.). Women who are not on ART and have recently been confirmed or diagnosed as HIV positive during ANC are immediately given a fixed-dose combination (FDC) of ART with one dose of Nevirapine (NVP) in order to prevent HIV from mother-to-child transmission (PMTCT). Once all ART drug contraindications have been ruled out, lifelong ART is initiated. In accordance with established guidelines, if the mother's syphilis screening test results are positive, long-acting penicillin treatment is administered to both her and her partner [25], [26].

An examination and assessment are conducted to identify or classify any obstetric and foetal risk (low, middle, and high) at the time of admission for delivery to the labour ward. Women with no obvious signs of high-risk pregnancy or delivery are allowed to give birth at KCHC. In contrast, those with high-risk issues are sent to a hospital by ambulance from an emergency medical rescue service. A partogram, a chart that documents all maternal and foetal observations, fluid intake and output, and medicines, monitors the course of labour. Alert and action lines on the partogram are used with other observations (e.g., the mother's temperature, blood pressure (BP), fetal heart rate, etc.) to identify labour issues for both women and foetuses. If a mother or newborn has issues or risk factors during labour that cannot be addressed at the MOU, such as high maternal blood pressure, eclampsia, foetal distress, poor labour progress, etc., hospitalization is advised. For women who give birth at the MOU without any problems, mothers and babies are observed for six hours after delivery. Demographic and obstetric information, ANC history, and any observations or test results obtained during or after delivery are all included in the birth registry. A woman or newborn is also referred to the hospital if any issues arise during the postpartum observation. Mothers with BBA were registered and offered care to both the mothers and the neonates. After receiving the proper counselling for postpartum and neonatal care, vaccinations, breastfeeding, family planning, etc., moms and newborns who are not complicated are returned home.

At KCHC, vaginal deliveries are the only procedure performed; no equipment like vacuums or forceps are used, and this MOU does not include labour augmentation. To detect HIV infection in utero, a birth polymerase chain reaction (PCR) test is performed on all live birth infants exposed to HIV. Furthermore, prophylactic nevirapine (NVP) is administered to all babies exposed to HIV for a minimum of six weeks following exposure. All high-risk neonates for mother-to-child transmission of HIV (MTCT) who are selected for breastfeeding should receive additional AZT for the first six weeks of their lives and NVP for a minimum of 12 weeks. When the VL is less than 1000 copies/ml or six weeks after birth, the mother stops breastfeeding, and NVP is stopped. All high-risk neonates who choose to be formula-fed should get AZT and NVP for six weeks. The Maternity and Neonatal Care Guidelines state that oral polio vaccine, BCG, and injectable vitamin K are among the extra neonatal care procedures. [26]. All neonates with HIV infection should begin ART regardless of birth weight [25], [26].

2.4. *Taking Ethics into Account*

The ethical approval was granted by the UMgungundlovu Health Ethics Review Board (Reference number UHERB 015/2020). The management of KCHC and the KZN provincial health research committee were consulted for permission. Informed consent is not necessary because the study used register review. Therefore, when presenting the results, the patient's name was not necessary.

2.5. *Data Analysis*

SPSS v24.0.1 (SPSS Inc., Chicago, IL, USA) was used to analyse data imported from the Microsoft Excel application. This information categorised cases as PTB (less than 37 weeks of pregnancy), LBW (less than 2500 g), and common to PTB and LBW. The clinical data of the previous menstrual cycle and, if available, an early prenatal ultrasound or fundal height corresponding to GA was used to determine gestational age. The examination of the patient's baseline demographic, obstetric, ANC indicators and pregnancy outcome data was summarised using descriptive summary measures, which are expressed as means with standard deviations (SD) for continuous variables and percentages for categorical variables. The data was separated into distinct groups to be analysed across the main variables. Pregnant women's ages were categorised into four groups: under 20 (teenage), 20–29, 30–39, and 40 years and above; their parities were separated into 0 (Nil), 1–2, 3–4, 4–5, and 6 or above. In GA, ANC initiation date was categorised as booking before 20 weeks (Yes/No); ANC booking status was further noted as either Yes or No; and the number of ANC visits was split into five groups: 0 (zero), 1–4, 5–7, and > 8 visits, the ANC site was classified as KCHC and other PHC clinics in the area. HIV and syphilis status were shown as either positive or negative, and the targeted birth PCR test findings of HIV-positive women were expressed as a percentage of live births of mothers with HIV. They were reported as either positive or negative. Pearson Chi-square (X2) and p values ($p < 0.05$) were used to link the dependent (exposure) and outcome variables. In bivariate analysis, like cross-table analysis, the outcome variables are binary, with 0 indicating the child did not have LBW, was not preterm, or both PTB and LBW and 1 indicating the child had LBW, was preterm or shared PTB and LBW. Significant prospective predictors for outcome variables were identified using binary logistic regressions with significant exposure factors. Independent models were applied to each dependent variable of interest: PTB, LBW, the common or both PTB and LBW delivery. Regression model results were expressed using relevant p-values, matching two-sided 95% CIs, and adjusted odds ratios (OR). A significant p-value was defined as less than 0.05.

3. Results

A total of 4057 women made up the study's sample out of the 4116 women who were registered in the birth registry; 59 of them had stillbirths and were not included in the analysis. Of them, 3875 (95.6%) women gave birth live at KCHC, while 180 (4.4%) moms had infants delivered before arrival (BBA). Thirty-three (18.3%) of the 180 BBAs did not schedule or start an ANC. Table I summarizes the antenatal care (ANC) indicators, pregnancy outcomes, and annual maternal demographic and obstetric features. With a mean age of 25.9 and a standard deviation (SD) of 5.7 years, the women's ages ranged from 14 to 46. Throughout the study period, there was no trend in the total number of live birth deliveries per year ($p > 0.05$). The distribution of ages across time showed no trends. Over three-quarters of them, however, are between the ages of 21 and 39. The average number of ANC visits among the women who received it was 5.8, with a standard deviation of 2.8. The minimum and greatest number of visits were 1 and 23, respectively.

Significant changes in ANC indices, pregnancy outcomes, obstetrics, and demographics were noted at KCHC between 2018 and 2022. From 58.9% in 2018 to 30.4% in 2022, the percentage of women receiving ANC at other PHC institutions decreased ($p < 0.001$). Between 2018 and 2022, the percentage of women who did not make an ANC reservation decreased from 5.5% 2018 to 3.5% in 2022 ($p = 0.013$). BBA rates also showed a downward trend, falling from a peak of 5.7% in 2018 to a low of 3.4% in 2022 ($p = 0.038$). Neonates of HIV-positive mothers had PCR positivity rates that decreased from 8.9% in 2019 to a lower rate of 2.5% in 2022 ($p = 0.038$). Pregnancies among women 40 years of age and older remained low, ranging from 0.6% to 1.3% ($p = 0.918$), whereas the percentage of deliveries among women under 20 years of age was constant, ranging from 14.1% to 16.0% ($p = 0.979$). Additionally, there were no discernible changes in the percentage of preterm deliveries, which ranged from 14.4% to 16.8% ($p = 0.487$).

TABLE I: Annual Demographic, Obstetric, ANC Indices and Pregnancy Outcome Trends from 2018 to 2022

Variables	2018	2019	2020	2021	2022	X^2 value	P value
No of deliveries	803	796	838	783	835	0.46	0.99
			Age category				
<20 years	113 (14.1)	120 (15.1)	134 (16.0)	113 (14.4)	121 (14.5)	4.231	0.979
20–29 years	467 (58.2)	452 (56.8)	468 (55.8)	455 (58.0)	474 (56.8)		
30–39 years	218 (27.1)	214 (26.9)	227 (27.1)	206 (26.3)	230 (27.5)		
≥40 years	5 (0.6)	10 (1.3)	10 (1.2)	10 (1.3)	10 (1.2)		
			Parity				
0 (Primigravida)	247 (30.8)	234 (29.4)	259 (30.9)	220 (28.1)	252 (30.2)	5.354	0.945
1–3	439 (54.7)	458 (57.6)	478 (57.1)	454 (58.0)	476 (57.1)		
4–5	106 (13.2)	93 (11.7)	90 (10.8)	97 (12.4)	94 (11.3)		
≥ 6	11 (1.4)	10 (1.3)	10 (1.2)	12 (1.5)	12 (1.4)		
			BBA				
No	757 (94.3)	751 (94.3)	808 (96.4)	752 (96.0)	807 (96.6)	10.118	0.038
Yes	46 (5.7)	45 (5.7)	30 (3.6)	31 (4.0)	28 (3.4)		
			Booked For ANC				
No	43 (5.4)	48 (6.0)	28 (3.3)	32 (4.1)	29 (3.5)	10.817	0.029
Yes	760 (94.6)	748 (94.0)	811 (96.7)	752 (95.9)	806 (96.5)		
			Booking Before 20 weeks gestation				
No	333 (43.8)	346 (45.5)	357 (43.5)	364 (47.8)	387 (47.4)	4.996	0.288
Yes	428 (56.2)	415 (54.5)	463 (56.5)	398 (52.2)	429 (52.2)		
			Number of ANC Visit				
0	56 (7.0)	44 (5.5)	31 (3.7)	38 (4.8)	38 (4.6)	25.319	0.013
1–3	246 (30.6)	222 (27.9)	211 (25.1)	194 (24.7)	210 (25.1)		
4–7	298 (37.1)	332 (41.7)	355 (42.3)	332 (42.3)	353 (42.3)		
8	203 (25.3)	198 (24.9)	242 (28.8)	220 (28.1)	234 (28.0)		
			ANC facility				
Other health facility	446 (58.7)	404 (53.2)	244 (29.8)	268 (5.2)	244 (29.9)	239.578	<0.001
At KCHC	314 (41.3)	355 (46.8)	575 (70.2)	494 (64.8)	571 (70.1)		
			HIV status				
Negative	449 (55.9)	462 (58.0)	514 (61.3)	485 (61.9)	519 (62.2)	10.125	0.038
Positive	354 (44.1)	334 (42.0)	325 (38.7)	299 (38.1)	316 (37.8)		
			Syphilis status				
Negative	786 (97.9)	777 (97.6)	827 (98.6)	769 (98.2)	820 (98.2)	2.311	0.679
Positive	17 (2.1)	19 (2.4)	12 (1.4)	14 (1.8)	15 (1.8)		
			Targeted PCR results of neonates of HIV positive mothers				
Negative	656 (95.5)	266 (91.1)	596 (95.5)	339 (95.2)	504 (97.5)	17.334	0.002
Positive	31 (4.5)	26 (8.9)	28 (4.5)	17 (4.8)	13 (2.5)		
			LBW				
No	751 (93.5)	736 (92.5)	758 (90.3)	713 (90.9)	759 (90.9)	7.336	0.119
Yes	52 (6.5)	60 (7.5)	81 (9.7)	71 (9.1)	76 (9.1)		
			Preterm Birth				
No	687 (85.6)	662 (83.2)	718 (85.6)	654 (83.4)	699 (83.7)	3.441	0.487
Yes	116 (14.4)	134 (16.8)	121 (14.4)	130 (16.6)	136 (16.3)		
			Common LBW and PTB				
No	769 (95.9)	751 (94.3)	797 (95.0)	750 (95.7)	792 (94.3)	2.703	0.609
Yes	33 (4.1)	45 (5.7)	42 (5.0)	34 (4.3)	43 (5.1)		

The percentage of women who scheduled ANC visits prior to 20 weeks of gestation was reasonably consistent at about 53% ($p = 0.228$), but the number of women who did not attend ANC fell from 6.0% in 2019 to 3.5% in 2022 ($p = 0.029$). The percentage of women receiving ANC at KCHC increased from 41.3% in 2018 to 70.1% in 2022 ($p < 0.001$), indicating a major shift in the use of ANC facilities. In contrast, the percentage of women attending other facilities considerably declined from 58.7% to 29.9%. The percentage of pregnant women with HIV decreased from 44.1% in 2018 to 37.8% in 2022 ($p = 0.038$), indicating a significant decline in HIV prevalence. Accordingly, the percentage of positive cases in neonates born to women with HIV decreased dramatically from 4.5% in 2018 to 2.5% in 2022 ($p = 0.002$), according to the findings of PCR tests. Throughout the study period, there was no discernible pattern in the distribution of parity, ANC care initiation prior to 20 weeks of GA, syphilis status, PTB, and both PTB and LBW rates.

380 (8.4%) women gave birth to LBW babies throughout 5 years; however, there was no apparent annual trend; rates ranged from 6.5% of live births in 2018 to 9.5% in 2020 ($p = 0.118$) for a 5-year total of 8.5%. While PTB rates varied between 14.4% and 16.8% during the study years without

any discernible variations, the total rate for the five years was 15.7% of all live births ($p = 0.487$). Throughout the five years, there were 197 (5.6%) live births; the LBW and PTB delivery rates varied from 4.1% in 2018 to 5.7% in 2019 ($p > 0.05$).

Table II shows the association between the exposure and outcome factors. The findings showed a strong correlation between the number of ANC visits and infant outcomes. Low birth weight (LBW) or PTB babies were more likely to be born to mothers who did not receive ANC initiation or visits. For example, mothers (4.4%) who did not attend ANC had significantly higher LBW (14.4%), PTB (11.5%), and common PTB and LBW (21.3%) birth rates of all live deliveries ($p < 0.05$). Mothers who had 1-3 ANC visits had a significantly higher incidence of LBW (31.2%), PTB (38.6%), and both (common) LBW and PTB (33.5%) of all live deliveries (26.7%) ($p < 0.001$). Similarly, women who received ANC at KCHC had a considerably lower rate of LBW (34.7%) ($p < 0.05$) than those who did not (59.0%). Mothers with HIV (40.1%) had significantly higher rates of LBW (47.4%) and PTB (46.2%) ($p < 0.05$). Furthermore, the number of LBW and PTB cases (combined) and syphilis infection showed substantial variations ($p < 0.001$). The actual syphilis incidence for the study period was 1.9%, but significantly higher rates of LBW (5.0%, $p < 0.001$) and PTB (3.0%, $p = 0.029$) deliveries. Moreover, complications were more common among moms who gave birth in the hospital before arrival (4.4%); 11.2% of their children had LBW, 10.4% were preterm, and 14.7% had both LBW and PTB problems ($p < 0.05$). Though the LBW delivery rate for the sample was 8.4%, the rate was significantly higher at 57.7% ($p < 0.001$) for the PTB group. Similarly, the PTB rate for the sample is 15.7%, but it is significantly higher at 39.1% ($p < 0.001$) for LBW babies. The mother's BBA, the ANC facility, the ANC booking status, the number of ANC visits, the mothers' HIV and syphilis status, and the targeted PCR results of the live birth neonates of mothers who were exposed to or had syphilis were all determined to be significant exposure factors for LBW babies. Mothers with BBA, ANC booking status before 20 weeks of pregnancy, number of ANC visits, ANC facility, HIV status, BBA, and LBW of the neonates were found to be significant exposure variables for PTB; for both PTB and LBW babies, having BBA, number of ANC visits, ANC booking status (yes or no), ANC booking before 20 weeks of pregnancy, and syphilis status coded were found to be significant. These variables were used separately for each outcome variable in binary logistic regressions to predict risk factors.

ANC at KCHC had a slightly higher OR of 1.4 (95% CI:1.1-1.8, $p = 0.004$), whereas no ANC had a higher OR of 9.3 (95% CI:3.94-22.22, $p < 0.001$), and ANC visit between 1-3 had an OR of 3.85 (95% CI:2.42-6.13, $p < 0.001$), according to Table III's logistic regression output for PTB. Conversely, the ORs for not having LBW and not having BBA were lower at 0.11 (95% CI:0.08-0.16, $p < 0.001$) and 0.47 (95% CI:0.28-0.79, $p = 0.004$), respectively.

Table IV on logistic regression for LBW revealed decreased ORs for not having BBA, not having syphilis, not having PTB, and having ANC at KCHC, respectively, of 0.38 (95% CI:0.22-0.67, $p < 0.001$), 0.33 (95% CI:0.13-0.63, $p = 0.002$), 0.11 (95% CI:0.08-0.16, $p < 0.001$), and 0.69 (95% CI:0.49-0.97, $p = 0.037$). Conversely, the OR of 2.90 (95% CL:1.24-6.78, $p = 0.014$) was higher for those who had no ANC (0 visits).

For both PTB and LBW deliveries, Table V, logistic regression revealed that women with BBA had a higher OR of 3.94 (95% CI:2.50-6.20, $p < 0.001$). When compared to those who had eight or more visits, those who had no ANC visit and fewer ANC visits had higher odds ratios (ORs) of 4.03 (95% CI:1.51-10.77, $p = 0.005$), 3.2 (95% CI:1.99-5.22, $p < 0.001$), and 1.9 (95% CI:1.22-3.02, $p = 0.005$) for those who had no ANC visit and those who had 1–3 and 4–7 visits, respectively. Conversely, women who started ANC before 20 weeks of GA and had ANC showed decreased ORs of 0.54 (95% CI: 0.33-0.87, $p = 0.013$) and 0.31 (95% CI:0.12-0.83, $p = 0.020$), respectively.

4. Discussion

This study only included pregnant women who delivered delivery at KCHC between 2018 and 2022. These figures included a lot of delivery data from the Kwadabeka and Clermont communities because it is believed that the majority of deliveries under public health facilities occur at KCHC. However, this study only included pregnant women who delivered delivery at KCHC. It was believed that five years would be a good amount of time to collect enough data for comparison, trend analysis, and risk factor identification for PTB and LBW deliveries. This data comprised a sizable portion of delivery data from the Kwadabeka and Clermont populations, as the majority of deliveries within the jurisdiction of public health facilities are believed to occur at KCHC. Nearly all (96%) of pregnant women in South Africa give birth in healthcare facilities with skilled birth attendants, and 97% of them are known to attend ANC at least once [27]. However, the percentage of pregnant women in our area who gave birth at public and private healthcare facilities remained unclear because the survey was facility-based. Because the KCHC is close by, the socioeconomic status of the catchment population is low, maternity healthcare is free for users in South African public health facilities, and there are policies in place to encourage pregnant women to use public health facilities for maternity care, including deliveries, one could expect a higher rate of use of these services by the target population. The retroactive review of birth registrations led to information bias, which further limited the study variables' availability. For instance, cultural practices and the financial status of pregnant mothers—known risk factors for LBW and PTB—were not included in the birth register [28], [29].

LBW, PTB, and both LBW and PTB did not exhibit any trends during the study period. PTB rates were from 14.4% to 16.8%, LBW babies delivered over 5 years ranged from 6.5% to 9.5% of live births ($p = 0.118$), and both LBW and PTB delivery rates ranged from 4.1% to 5.7% without any significant difference ($p > 0.05$). Over the course of five years, the total statistics revealed that 8.4% of women had LBW, 15.7% had PTB, and 4.9% had both. Perinatal, neonatal, and post-neonatal outcomes are significantly

TABLE II: Cross-Table Analysis of Exposure and Outcome Variables with Pearson's Chi-Square and P-Values

Variables	Sample frequency (%)	LBW frequency (%)	X^2 values	P values	PTB frequency (%)	X^2-values	P values	Both LBW and PTB frequency (%)	X^2-values	P values
					Age coded					
<20 years	601 (14.8)	46 (13.5)	3.515	0.319	91 (14.3)	6.106	0.107	28 (14.2)	0.590	0.899
20–29 years	2316 (57.1)	197 (57.9)			360 (56.5)			110 (55.8)		
30–39 years	1095 (27.0)	90 (26.5)			173 (27.2)			56 (28.4)		
≥40 years	45 (27.0)	7 (2.1)			13 (2.0)			3 (1.5)		
					Parity					
Nil (0)	1212 (29.9)	106 (31.2)	7.496	0.058	169 (26.5)	6.153	0.104	58 (29.4)	8.882	0.031
1–3	2305 (56.9)	203 (59.7)			384 (60.3)			126 (64.0)		
4–5	480 (11.8)	25 (7.4)			72 (11.3)			11 (5.6)		
6	55 (1.4)	6 (1.8)			12 (1.9)			2 (1.0)		
					ANC Booking before 20 weeks gestation					
No	1787 (45.6)	151 (50.3)	2.951	0.086	321 (55.2)	25.675	<0.001	81 (49.4)		
Yes	2133 (54.4)	149 (49.7)			260 (44.8)			83 (50.6)	1.006	0.316
					Number of ANC Visit					
0 (nil)	207 (5.1)	50 (14.7)	86.318	<0.001	80 (12.6)	170.943	<0.001	43 (21.8)	134.392	<0.001
1–3 visits	1083 (26.7)	106 (31.2)			246 (38.6)			63 (32.0)		
4–7 visits	1670 (41.2)	128 (37.6)			212 (33.3)			66 (33.5)		
≽ 8 visits	1097 (27.0)	56 (16.5)			99 (15.5)			25 (12.7)		
					Booking status for ANC					
No	180 (4.4)	49 (14.4)	87.088	<0.001	73 (11.5)	87.908	<0.001	42 (21.3)	139.147	<0.001
Yes	3877 (95.6)	291 (85.6)			564 (88.5)			155 (78.7)		
					ANC Facility					
Other health facility	1606 (41.0)	104 (34.7)	5.423	0.020	345 (54.2)	10.261	0.001	65 (39.6)	0.133	0.715
At KDC	2309 (59.0)	196 (65.3)			292 (45.8)			99 (60.4)		
					HIV status					
Negative	2429 (59.9)	179 (52.6)	8.062	0.005	365 (53.8)	10.261	0.001	105 (53.3)	3.740	0.053
Positive	1628 (40.1)	161 (47.4)			313 (46.2)			92 (46.7)		
					Syphilis status					
Negative	3979 (98.1)	323 (95.0)	19.169	<0.001	618 (97.0)	4.771	0.029	185 (93.9)		
Positive	77 (1.9)	17 (5.0)			19 (3.0)			12 (6.1)	19.537	<0.001
					Targeted PCR					
Negative	2361 (95.4)	194 (95.1)	0.033	0.855	371 (94.2)	1.506	0.220	102 (94.4)	0.211	0.646
Positive	115 (4.6)	10 (4.9)			23 (5.8)			6(5.6)		
					Mothers having BBA					
No	3875 (95.6)	302 (88.8)	39.714	<0.001	571 (89.6)	62.481	<0.001	168(85.3)	51.580	<0.001
Yes	180 (4.4)	38 (11.2)			66 (10.4)			29(14.7)		
					LBW					
No	3717 (91.6)				137 (43.3)	542.91	<0.001			
Yes	340 (8.4)				203 (57.7)					
					PTB					
No	3420 (84.3)	434 (68.1)	542.91	<0.001						
Yes	637 (15.7)	203 (31.9)								

influenced by birth weight. The rates of 13.5% and 13% reported in previous SA (hospital-based study) and SSA studies seem to be higher than the LBW rate [7], [16]. Nonetheless, a PHC facility in the SA province of KZN observed comparable LBW deliveries (ranging from 6.7% to 8.4%) [30]. Low-income nations have a wide range of LBW delivery rates. For instance, a recent multicounty study revealed that the overall LBW rate was 13.6%, with variations ranging from 2.7% in Kenya to 21.4% in Pakistan [7]. The nature of the studies may account for these variations in LBW delivery rates. For example, whereas the current study was conducted at a community-based PHC health facility, deliveries at tertiary hospitals may be linked to complicated pregnancies that end in preterm birth [16].

Our study's PTB rate of 15.7% was slightly lower than the 16.4% rate from Durban Hospital in SA and SSA [7], [16]. It is also discovered that PTB rates vary greatly among low-income nations. For instance, Belagavi and India had an 8.6% rate, a PHC health centre in Durban, South Africa, had a considerably lower incidence of 5.4% [30], and Pakistan had a higher rate of 21.8% [7]. The preterm birth rate has not changed much on a global scale between 2010 (9.8%) and 2020 (9.9%) live births. Similarly, PTB rates have changed very little or not at all over the past ten years across geographies, with sub-Saharan Africa (10.1%)

TABLE III: Logistic Regression Output for PTB

Variables	Sig. (p values)	Adjusted Odds Ratio (OR)	95% CI for OR	
			Lower	Upper
ANC at KCHC	0.004	1.426	1.117	1.820
Not having BBA	0.004	0.475	0.286	0.790
No of ANC visit	0.000			
Having no ANC (0)	0.000	9.366	3.94	22.224
Having ANC visits (1–3)	0.000	3.857	2.427	6.130
Having ANC visits (4–7)	0.754	1.092	0.629	1.895
Not having LBW (>2.5 kg)	0.000	0.105	0.078	0.144
Constant	0.853	1.066		

Note: Variable(s) entered on step 1: ANC facility coded, having BBA coded, ANC booking before 20 weeks gestation, No of ANC visits coded, Syphilis and HIV status coded, ANC Booking status coded and LBW coded. Comparison group: ANC at other PHC facilities, having BBA, number of ANC visits ≥ 8, having LBW.

TABLE IV: Logistic Regression Output for LBW

Variables	Significance. (p values)	Adjusted Odds Ratio (OR)	95% CI for OR	
			Lower	Upper
ANC at KCHC	0.037	0.693	0.490	0.979
Not having BBA	0.000	0.385	0.220	0.675
Number of ANC visit	0.069			
	0.014	2.903	1.242	6.787
1–3	0.542	1.415	0.463	4.324
4–7	.0167	1.587	0.824	3.056
Not having Syphilis	0.002	0.292	0.134	0.636
Not having PTB	0.000	0.115	0.082	0.162
Constant	0.057	2.782		

Note: Variable(s) entered on step 1: ANC facility, having BBA, number of ANC visits, syphilis and HIV status, targeted birth PCR test result, booked for ANC and preterm birth coded. Comparison group: ANC at other PHC facilities, having BBA, having syphilis and having PTB.

TABLE V: Logistic Regression Output for Both PTB and LBW Deliveries

Variables	Significance (p values).	Adjusted Odds ratio (OR)	95% CI for OR	
			Lower	Upper
Having BBA	0.000	3.944	2.505	6.208
ANC Booking before 20 weeks of GA	0.013	0.54	0.331	0.879
Number of ANC Visit	0.000			
Having No ANC (0)	0.005	4.039	1.514	10.778
ANC visits (1–3)	0.000	3.228	1.993	5.227
ANC visits (4–7)	0.005	1.923	1.222	3.026
Had ANC	0.020	0.318	0.121	0.838
Syphilis status positive	0.050	2.204	1.000	4.861
Constant	0.000	0.057		

Note: Variable(s) entered on step 1: BBA, Number of ANC visit, booked for ANC, Syphilis status, ANC booking before 20 weeks gestation coded. Comparison group: not having BBA, number of ANC visits ≥ 8, never booked for ANC, syphilis status negative, ANC booking after 20 weeks of GA.

and southern Asia (13·3%) having the highest burden in 2010 and 2020, respectively [31]. Additionally, our study's PTB and LBW delivery rates are both below the global averages of 11% and 23.4% of all births, respectively [1], [2], [5]. Our research's total PTB and LBW delivery rate was 5.6%, which is comparable to a study that showed a rate of 5.5% from six low- and middle-income nations (with Pakistan having the highest rate at 11.0% and Kenya having the lowest at 1.2%) [17].

The number of ANC visits was one of the common risk variables linked to PTB, LBW, and both. For instance, our study's higher ORs were comparable to those of earlier studies when (0) or fewer than four ANC visits were present [4], [17]. According to our findings, people who had no ANC (no ANC visit) were more likely to have PTB than those who had eight or more visits. Those who had an ANC visit between one and three times were nearly four times (OR = 3.85) more likely to have PTB. Similarly, it was nearly three times more likely to have LBW if there was no ANC (0 visits) (OR = 2.9). Women who had no ANC visit, ANC visits between 1–3, and ANC visits between 4–7 had higher odds ratios (ORs) of 4.0, 3.2, and 1.9 times ($p < 0.05$) for both PTB and LBW, respectively, than women who had eight or more ANC visits. Our data supports the WHO's most recent recommendation of eight or more ANC visits for improved pregnancy outcomes [32]. However, the OR for women who scheduled or started ANC prior to 20 weeks of GA was 0.54, meaning that they were 46% less likely to have both PTB and LBW births. Therefore, it is crucial to remember that early ANC initiation is necessary to safeguard against PTB and LBW deliveries. Therefore, it is crucial to work on lowering the prevalence of LBW and PTB, which includes enrolling all expectant mothers in ANC. In order to prevent preterm birth, WHO's antenatal care guidelines recommended a minimum of eight visits with health professionals during pregnancy, beginning before 12 weeks, to identify and manage risk factors like infections; foetal measurements, including the use of early ultrasound to help determine gestational age and detect multiple pregnancies; and counselling on healthy diet, optimal nutrition, and prevention of tobacco and substance use [32], [33].

Treatments are available to assist in protecting the preterm infant from potential neurological impairment, as well as breathing issues and infection, if a woman experiences preterm labour and is in danger of giving birth prematurely. These include antibiotics for cases of premature prelabour rupture of membranes (PPROM) and prenatal steroids and tocolytic therapies to postpone labour [32], [34]. LBW and PTB are more likely to occur in many of these women who receive insufficient ANC. Furthermore, many individual interventions that could help lower the incidence of both LBW and PTB need involvement in an ANC system. When the World Health Organization (WHO) discovered evidence of a higher risk of perinatal deaths associated with four or fewer ANC visits, they created a new guideline. [33] In November 2016, WHO released its comprehensive guidelines on ANC visits of eight or more visits for a joyful pregnancy experience, emphasizing person-centred care and well-being in addition to avoiding maternal and perinatal death and morbidity [32], [34]. In order to prevent such a catastrophe, this intervention also included additional ANC visits during the final trimester of pregnancy, between 32 and 36 weeks of GA, when the majority of intrauterine foetal fatalities (stillbirths) occur [33].

Although there are several prenatal possibilities to lower the prevalence of low birth weight, these are frequently disregarded in favour of prenatal interventions. Healthy pregnancies, in essence, start before conception. This highlights the significance of identifying pre-pregnancy risks, providing counselling, and reducing those risks through health education about pregnancy outcomes in general and low birthweight in particular, as well as the full availability of family planning services, particularly for women and adolescents with low incomes. Additionally, a healthy pregnancy is the first step in preventing PTB and LBW-related deaths and problems. In order to prevent preterm birth, WHO's antenatal care guidelines recommended a minimum of eight visits with health professionals during pregnancy, beginning before 12 weeks, to identify and manage risk factors like infections; foetal measurements, including the use of early ultrasound to help determine gestational age and detect multiple pregnancies; and counselling on a healthy diet, optimal nutrition, and prevention of tobacco and substance use [32]. WHO also released updated guidelines for PTB care in 2022. These are based on recent research showing that preterm and low birthweight babies can significantly lower their mortality rates with straightforward interventions like kangaroo mother care right after birth, early breastfeeding initiation, continuous positive airway pressure (CPAP), and medications like caffeine for respiratory issues. [4] In order to arrive at this conclusion, the previous report thoroughly examined the data demonstrating the efficacy of prenatal care and came to a conclusion that, despite a small number of studies that failed to show a positive impact of prenatal care, the overwhelming majority of the evidence suggests that prenatal care lowers low birth weight, with the effect being greatest among high-risk women. A wide national commitment to guaranteeing that all pregnant women, particularly those who are at socioeconomic or medical risk, receive high-quality prenatal care is supported by this conclusion [32], [34].

BBA was discovered to have a range of emotional responses at a maternity unit in South Africa. Examples include humiliation, anxiety, worry, and wrath. In several instances, the participants felt at ease giving birth at home. The most difficult experience was when paramedics took a long time to respond and arrive after a call-out [35]. Some midwives at the maternity ward were unsupportive to pregnant mothers from South Africa, displaying no empathy and failing to provide the desired level of privacy. BBA continues to be a worldwide and local issue that impacts both high- and low-income nations. For instance, unattended births at home and while travelling to the hospital accounted for 3.2% of BBAs in the Maribor region of Slovenia [36]. With an average rate of 4.2% from 1992 to 2011, the tendency is also noticeable in Australia [37]. The BBA rate has also been steadily rising in South Africa; for instance, it was 5.4% in 2009 [38] and 10% in 2013 [39], compared to 5.7% in KwaZulu-Natal and 5% in Gauteng. Our study's BBA rate was 4.4%, which is consistent with previous research [39], [40]. LBW (OR = 0.38) and PTB (OR = 0.47) were found to be protected against by not having BBA in our study, meaning that LBW and PTB were 62% and 53% less likely to occur, respectively. Conversely, women with BBA had a higher OR of 3.9, meaning they were nearly four times as likely to encounter both LBW and PTB. As more newborns were linked to being hospitalized for PTB (40.7%), respiratory distress (25.3%), and birth asphyxia (13.2%), similar results were published from other studies showing that BBA was a risk factor (OR = 8.3) for PTB [41]. The same study also found that inadequate ANC quality (OR = 4.7), a lack of emergency preparedness (OR = 2.7), and a lack of birth preparedness (OR = 4.1) were associated with BBA. Thus, the amount and quality of ANC among expectant mothers continued to be a significant public health concern and intervention problem.

PTB and LBW deliveries are observed to be connected. For instance, the PTB group had a considerably higher rate of 57.7% ($p < 0.001$) than the sample's LBW delivery rate of 8.4%. The PTB rate for LBW newborns is much higher at 39.1% ($p < 0.001$) than the sample rate of 15.7%. Because of this, the models in our study projected that LBW newborns are protected from PTB, with an OR of 0.11 ($p < 0.001$), which indicates an 89% lower risk of LBW pregnancy. The OR for PTB was 0.10 ($p < 0.001$) for babies without LBW, suggesting that 90% of PTB would be prevented. This suggests that LBW babies are also protective against PTB. A study conducted in India revealed the type and degree of correlations [42].

5. Conclusion

In many rural or semi-rural areas, preterm birth, LBW, and their combination remain prevalent public health issues, especially for expectant mothers who have not received adequate prenatal care. Our investigation found no discernible patterns in the rates of PTB or LBW. BBA, HIV, syphilis, and PCR-positive rates were on the decline, while ANC and pregnant women receiving ANC were on the rise at KCHC. For both LBW and PTB, there was a single predictor of ANC visit numbers (having no or lower numbers of ANC visits). Risk variables for LBW and PTB were the number of ANC visits at other PHC clinics in comparison to KCHC, BBA, and HIV and syphilis infections. In order to decrease unfavourable pregnancy outcomes, social factors must be incorporated into maternal health programs. Additionally, comprehensive reproductive health services that target high-risk groups must be made accessible and available. It is advised that more research be done to determine the prenatal care and delivery procedures used, as these could be linked to bettering maternity services and raising the facility's delivery metrics. Continue to support and encourage early ANC attendance by educating households and communities about health issues.

Author Contributions

AMH: Conceptualized the research idea and participated in data collection and manuscript write-up.

MH: Conceptualized research idea and data analysis and participated in the manuscript write-up.

RH: Involved in data coding, analysis, and finalization of the manuscript.

MA: Conceptualized the research idea, wrote it up, and finalized the manuscript.

SB: Performed data analysis and participated in research write-up.

Conflict of Interest

The authors declare that they do not have any conflict of interest.

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