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RESEARCH ARTICLE

Clinical Audit of Birth Before Arrival at a Midwife Obstetric Unit from South Africa during 2018 to 2022

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ABSTRACT

Given its link to maternal and perinatal morbidity and mortality, birth before arrival (BBA) is a public health concern. The purpose of this study was to evaluate the prevalence, trends, outcomes, and contributing factors of BBA among women who gave birth in a South African midwife obstetric unit between 2018 and 2022. A cross-sectional descriptive analysis was carried out among women who gave birth and saw a BBA right away using data from the labor ward birth registration. Variables with a p value of less than 0.05 were deemed significant, and descriptive statistics like frequency, cross table analysis, and binary logistic regression analysis were calculated. 4.8% of people had BBA (95% CI: 4.4, 4.9). Between 2018 and 2022, BBA decreased from 5.2% to 3.8% (p = 0.021). Women with nil parity (OR = 0.054, 95% CI; 0.021:0.140, p < 0.001), parity 1–2 (OR = 0.164, 95% CI; 0.076:0.350, p < 0.001), and parity 3–4 (OR = 0.27, 95% CI; 0.12:0.60, p = 0.001) were the variables linked to BBA in logistic regression. Comparing women who received ANC at KCHC to those who received ANC at another medical facility, the former had a lower OR of 0.63 (95%CI; 0.44:0.91, p = 0.014). Conversely, compared to women who had nine or more antenatal care (ANC) visits, those who had none (ANC visit 0 or never scheduled for ANC) had a higher OR of 3.41 (95%CI; 1.205:9.66, p = 0.021). Preterm birth (PTB) had an OR of 1.53 (95% CI: 1.05:2.22, p = 0.024), while Low birth weight (LBW) had an OR of 2.41 (95% CI: 1.53:3.79, p < 0.001). According to the survey, the prevalence of BBA is trending downward. These results demonstrated how crucial early ANC scheduling and sufficient prenatal care are to enhancing pregnancy outcomes.

Keywords: Antenatal care, kwadabeka CHC, low-risk pregnancies, midwife obstetric unit.

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1. Introduction

Birth before arrival (BBA) is the term used to describe a child delivered at home or while traveling to a medical facility and receiving maternal and neonatal care [1]. There is no midwife or medical officer present for these births outside of medical institutions, which may occur in ambulances, at home while preparing, or during the journey to the hospital [2], [3]. Accessibility to perinatal care is gauged by the BBA rate; a rate higher than 1.5% indicates problems with the delivery of healthcare. It is advised to do additional research and implement suitable measures if such a rate is present [4]. With 96% of women reporting one or more ANC visits and 94% having skilled birth attendants during delivery, South Africa (SA) has higher overall rates of maternal health service utilization [5]. Unfavorable maternal and perinatal morbidities and mortality rates are linked to BBAs [6], [7]. Less than 1% of people in developed nations have BBA [8], [9] whereas in low-income nations, such as Ethiopia and India, the prevalence rate rises rapidly to 50% [1], [10]. According to a recent Ethiopian study by Amanuel *et al*. (2024), the prevalence of BBA is 15.2% [11]. The national home delivery or delivery by traditional healers (not qualified birth attendant) rate in SA is 8%, according to SA Demographic and Health Survey Report

(SADHS) 2018 [5]. Premature and low birth weight deliveries are among the more common issues are linked to BBAs earlier study found from KZN [1].

According to a 2009 report, the incidence of BBA in SA was 5.7% in KwaZulu-Natal (KZN) and 5% in Gauteng Provinces [1]. According to 2017 research, the district-level BBA rate in SA's Nkangala District was 4.6% [12]. According to a 2022 study report from a Durban hospital, the incidence of BBAs is 2.2% [13]. As a result, prevalence rates differ both domestically and internationally. The prevalence rates in SA, however, are not widely known. Prematurity and birth asphyxia are the main obstetric factors causing perinatal deaths in SA [14], [15]. Higher infant mortality rates and poor perinatal outcomes are caused by BBAs [16]. The other reports, compared to hospital-born babies, BBAs may have an 11-fold higher mortality rate and a two-fold higher morbidity rate [17]. According to a KZN study, having a BBA increases the risk of preterm and low birth weight deliveries by 3.9 times [12]. BBAs are also found with high-risk and vulnerable population that is prone to higher rates of maternal and perinatal morbidity and mortality [1], [18]–[20]. Hypothermia, asphyxia, respiratory distress, low birth weight, neonatal sepsis, and an increased risk of mother-to-child HIV transmission are among the common outcomes of BBAs on neonates, with hypothermia being the most common [6], [21]–[24].

Postpartum hemorrhage from uterine atony, retained placenta and products of conception, perineal rips and cuts, and puerperal infection are among the maternal problems that might arise from a BBA [22]. An estimated 4 million newborn fatalities and a comparable number of stillbirths occur each year worldwide as a result of BBAs [25]. South-central Asian nations account for the greatest number of newborn mortality, while sub-Saharan Africa (SSA) often has the highest rates of BBA [25], [26]. Around 36% of newborn deaths take place within the first 24 hours of life, and the majority of neonatal deaths (73%) happen during this time. BBA infants with advanced outcomes also die during this time. Effective health interventions after birth and the first week of life could avert up to two-thirds of newborn deaths [26], [27]. Nonetheless, 5.2 million deliveries worldwide, including BBA, take place without a person present [28].

According to earlier research, the main risk factors for BBA are the interaction of social, obstetric, and demographic factors [29]–[31]. Nonetheless, these elements are crucial in determining how much it contributes to health disparities [32]. The characteristics of regionally marginalized communities are frequently reflected in the social risk factors [33]. Early risk categorization is therefore necessary since it may give high-risk patients more time to implement preventative interventions such as patient education, customized prenatal care planning, and social support solutions [34].

Some African studies have shown that BBAs are linked to sociodemographic factors like low maternal age, low educational attainment, living in a rural area, being married, and having a low monthly income; obstetric factors like poor ANC attendance, adolescent and unwanted pregnancies, the mode of previous delivery, birth plans, and recognizing the onset of labour; and access factors like limited access to health care and transportation [2,21,35–38]. Important risk factors for birth asphyxia, and mortality include low birthweight newborns, poor early care of the newborn, diminished antenatal trend, and lack of transportation from home [39]. Furthermore, additional research found that factors like parity, ethnicity, multidimensional deprivation, employment status, booking timing, and distance from home to the closest maternity care unit are predictors of BBAs that can be detected at booking [40].

We conducted a study to evaluate the prevalence, consequences, and risk factors for BBAs who presented at a Community Health Centre (CHC) in Durban, South Africa, using our knowledge of the prevalence, repercussions, and risk factors of BBA from various locations and times. The study's main goal was to compare the perinatal morbidity and mortality rates of babies born in a MOU and BBAs. The study also aimed to determine the traits of mothers and their infants and demonstrate a trend in the incidence of BBAs. By determining risk variables, assessing results, and formulating suggestions to enhance maternal and neonatal care in this patient population, the study aimed to advance our knowledge of BBAs.

2. Materials and Method

2.1. Study Design, Sample Selection and Data Collection

At a midwife obstetric unit (MOU) of Kwadabeka Community Health Centre (KCHC) located in Clearmont and Kwadabeka townships of KZN, South Africa, a retrospective cohort study was conducted. The women who gave birth at (KCHC) from January 1, 2018 to December 31, 2022 were the study subjects. The "birth register," also referred to as the "delivery register," provided the information for the study, which was conducted from July to March of 2023. The birth register was used to gather demographic, obstetric, and medical information about all mothers and newborns. The specifics of every delivery at KCHC and BBAs are formally documented in the registry. The register contained minimum factors related to pregnant women's demographic and obstetric data such as maternal postpartum hemorrhage (PPH) and low birth weight (LBW) deliveries, and neonates' preterm, stillbirth and early neonatal mortality (death of a live birth neonate within 7 days), (ENND). This study included the following exposure variables: age, parity, gestational age (GA) at delivery, antenatal care (ANC) location (facility), number of ANC visits, ANC booking before 20 weeks of GA, the presence of HIV and syphilis infections.

2.2. Setting and Population

For more than 150,000 primarily Black residents of the two townships, KCHC acts as a PHC facility. It is located inside the municipal limits of eThekwini (Durban). In the KCHC catchment region, there are seven more fixed PHC clinics that are operated by KCHC and provide PHC service packages that include prenatal and postnatal care but do not include delivery services. Based on the principles of the District Health System, which has been in existence since 1994 as SA became more democratic, pregnant

women from those clinics use KCHC for delivery services [33]. 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 do the same during the evening (4 pm to 7 am), in addition to other support staff. The national protocol and guidelines, which have been in effect since 2002 and have been revised in 2016 and 2023, are followed when providing prenatal care and delivery services. This study does not include high-risk pregnancy issues that are identified during prenatal care because they are sent to hospitals.

2.3. *Care During Delivery for Mothers and Neonates*

When a pregnant woman arrives at KCHC experiencing labor pain, an examination and assessment are conducted to diagnose or classify any obstetric and fetal dangers according to National Guidelines on maternity care in SA [41]. Women are allowed to give birth at KCHC if there is no obvious risk or if there are no imminent delivery issues; those who do have issues are transported to a hospital by emergency medical rescue ambulance. In cases where the MOU is unable to handle mother and infant issues or risk factors (such as high maternal blood pressure, eclampsia, fetal distress, etc.) during labor, hospitalization is undertaken. For women who give birth at the MOU without any problems, mothers and babies are observed for eight hours after delivery. Demographic and obstetric information, as well as any observations and test findings obtained before and after delivery, are all included in the birth register. KCHC monitors uncomplicated women and infants for eight hours before sending them home after receiving the proper counselling on topics such as family planning, nursing, vaccines, postpartum and neonatal care, etc. At KCHC, only vaginal deliveries are performed; no tools like vacuums or forceps are used. A mother or newborn is also referred to the hospital if they experience any difficulties during the postpartum phase. For the mother's postnatal treatment, KCHC is notified if a referred infant passes away in the hospital within seven days. This MOU does not use labor augmentation. The national guideline for management of HIV among mothers and neonates at delivery was followed [41].

2.4. *Ethical Consideration*

The ethical approval was granted by the UMgungundlovu Health Ethics Review Board (Reference number. UHERB 015/2020). The management of KCHC also granted permission. Informed consent wass not necessary because the study used register review.

3. Data Analysis

SPSS 27.0.1 (SPSS Inc., Chicago, IL, USA) was used to analyze data that was imported from the Microsoft Excel application. The examination of the patient's baseline demographic and pregnancy outcome data was summarized using descriptive summary measures, which are expressed as means with standard deviations (SD) for continuous variables and percentages for categorical variables. The main dependent variables were separated into several groups in order to analyse. The pregnant women's ages were separated into four groups: under 20 years old (teenage), 20–29, 30–39, and 40 years or above. Their parity was classified into 0 (Nil), 1–2, 3–4, and 5 or above. ANC initiation timing (GA) was defined as booking before 20 weeks (Yes/No), ANC booking status was either Yes or No, and the ANC site was classified as KDC and other medical facilities. Six categories were used to group ANC visits: 0 (nil), 1–2, 3–4, 5–6, 7–9, and 9 or more visits. The syphilis (using the RPR test results) and HIV (using ELISA test results) status were shown as either negative or positive. The outcome variable for the study was BBA (having binary values of Yes = 1 and no = 0).

The consequences of BBAs on maternal and neonates were measured using yes or no for maternal PPH, preterm birth, LBW deliveries, live births, stillbirths and ENND. The corelation between BBA and pregnancy outcomes or consequences were measured with Pearson's corelation test and p values. Preterm birth (PTB) and LBW were measured with gestational age (GA < 37 weeks) and neonate's birth weight (<2.5 kg), respectively.

The dependent (exposure) and outcome variables were associated using Pearson Chi-square (X2) and p values ($p < 0.05$) in bivariate analysis, such as cross table analysis. Binary logistic regression with significant exposure variables was used to find significant prospective predictors for outcome variables. Adjusted odds ratios (OR), matching two-sided 95% confidence interval CIs, and related p-values were used to express the outcomes of regression models. The P-value was recorded as less than 0.001 (<0.001) if it was 0.000 or less. P values < 0.05 was considered significant.

4. Results

Over the course of five years, the prevalence of BBA was 4.8% (95% CI: 4.6–4.9). BBA at this PHC facility did, however, according to Table I showed a downward tendency, falling from a higher rate of 6.4% in 2019 to a lower rate of 3.8% in 2022 ($p = 0.021$). According to an analysis of the 2018–2022 trend, the BBA rate peaked in 2019 at 6.4%, then declined in 2020 at 3.5%, and then fluctuated in subsequent years.

There are noteworthy correlations between maternal variables and BBA, according to the cross-tabulation in Table II. In comparison to other groups, where BBA rates rose to 7.6% and 11.4% in age groups 30–39 and >40 years, respectively. Younger mothers, age groups <20 and 20–29 years, had considerably lower BBA rates (3.6% each) ($p < 0.001$). Mothers with parity five or more (prior births) had the highest rate (25.5%) of BBAs, compared to just 2.0% for mothers in parity 0, 4.8% for mothers in parity 1–2, and 9.1% for mothers in parity 3–4 ($p < 0.001$). Higher parity groups of women had considerably and significantly higher rates of BBAs ($p < 0.001$). Booking prenatal care was important for BBA; mothers who did not book prenatal care had a significantly higher rate of BBA (25.0%) than those who booked for ANC (3.8%) ($p < 001$), and those who booked ANC before 20 weeks of gestation had a lower rate of BBA (3.8%) than those who booked after 20 weeks of GA (25.0%) ($p < 0.001$).

TABLE I: Annual Prevalence of BBA Over the Study Period 2016 to 2022

	2018	2019	2020	2021	2022	X^2	P
BBA-Yes frequency, (n) and percent (%)	47 (5.7%)	52 (6.4%)	30 (3.5%)	35 (4.4%)	32 (3.8%)	11.568[a]	0.021
No-percent (%)	94.3%	93.6%	96.5%	95.6%	96.2%		

TABLE II: Output of Cross-Table Analysis Between Exposure and Outcome Variables with X^2 and P Values

Variables	Actual sample n & (%)	BBA-No n & %	BBA–Yes (Count & %)	X^2-value	P-value
Age group					
≤19 years (teenage)	613 (14.9)	591 (96.4%)	22 (3.6%)	32.361	<0.001
20–29 years	2351 (57.1)	2266 (96.4%)	85 (3.6%)		
30–39 years	1107 (26.9)	1023 (92.4%)	84 (7.6%)		
≥40 years	45 (1.1)	39 (88.6%)	5 (11.4%)		
Parity					
0 (nil)	1233 (30.0)	1208 (98.0%)	25 (2.0%)	91.831	<0.001
1–2	2337 (56.8)	2224 (95.2%)	113 (4.8%)		
3–4	486 (11.8)	442 (90.9%)	44 (9.1%)		
≥5	55 (1.3)	41 (74.5%)	14 (25.5%)		
Booked for ANC					
No	188 (4.6)	141 (75.0%)	47 (25.0%)	177.795	<0.001
Yes	3928 (95.4)	3777 (96.2%)	149 (3.8%)		
Booking before 20 weeks					
No	1816 (45.7)	1715 (94.5%)	99 (5.5%)	14.866	<0.001
Yes	2157 (54.3)	2092 (97.0%)	65 (3.0%)		
ANC facility					
At KCHC	1637 (41.3)	1586 (96.9%)	50 (3.1%)	8.177	0.004
Other health facility	2331 (58.7)	2216 (95.1%)	114 (4.9%)		
Number of ANC visit					
0 (nil)	188 (4.6)	169 (77.5%)	49 (22.5%)	42.215	<0.001
1–2	346 (8.4)	322 (93.3%)	23 (6.7%)		
3–4	764 (18.6)	731 (95.7%)	33 (4.3%)		
5–6	1188 (28.9)	1139 (96.0%)	48 (4.0%)		
7–8	988 (24.0)	959 (97.1%)	29 (2.9%)		
≥ 9	612 (14.9)	598 (97.7%)	14 (2.3%)		
HIV status					
Negative	2457 (59.7)	2366 (96.3%)	90 (3.7%)	16.244	<0.001
Positive	1659 (40.3)	1552 (93.6%)	106 (6.4%)		
Syphilis status					
Negative	4034 (98.0)	3845 (95.4%)	187 (4.6%)	7.332	0.007
Positive	81 (2.0)	72 (88.9%)	9 (11.1%)		
Preterm birth (GA at birth)					
Yes (<37 weeks)	1140 (27.7)	1045 (91.7%)	94 (8.3%)	42.215	<0.001
No (≥37 weeks)	2975 (72.3)	2872 (96.6%)	102 (3.4%)		
Low birth weight deliveries					
Yes	414 (10.1)	362 (87.4)	52 (12.6)	61.633	<0.001
No	3701 (89.9)	3557 (96.1)	144 (3.9)		
PPH (Postpartum hemorrhage)					
No	4078 (99.2)	3884 (95.3%)	194 (4.7%)	1.241	0.265
Yes	34 (0.8)	31 (91.2%)	3 (8.8%)		
Still Birth					
No	4056 (98.5)	3874 (95.6%)	180 (4.4%)	64.376	<0.001
Yes	60 (1.5)	44 (73.3%)	16 (26.7%)		
Early neonatal death (<7 days)					
No	4080 (99.1)	3884 (95.2%)	194 (4.8%)	0.050	0.823
Yes	36 (0.9)	34 (94.4%)	2 (5.6%)		
Live birth					
No	63 (1.5)	47 (74.6%)	16 (25.4%)	60.029	<0.001
Yes	4053 (98.5)	3871 (95.6%)	180 (4.4%)		

Women who attended KCHC had a lower rate of BBA (3.1%) compared to those at other health health facility (4.9%) ($p = 0.004$), suggesting that the type of ANC facility also had an effect on BBAs. The group of pregnant women who had no or few ANC visits had higher rates of BBAs than the group that had nine or more ANC visits. For

TABLE III: Corelation of BBA and Pregnancy Outcome Variables

				BBA	PPH	PTB	Live birth	Still birth	ENND	LBW
BBA	Pearson correlation			1	0.017	−0.157**	−0.121**	0.125**	0.003	−0.122**
	Sig. (2-tailed)				0.266	0.000	0.000	0.000	0.825	0.000
	Sum of squares and cross-products			186.648	1.378	−382.198	−12.994	13.137	0.282	−32.247
	Covariance			0.045	0.000	−0.093	−0.003	0.003	0.000	−0.008
	N			4108	4108	4108	4108	4108	4108	4108
	Bootstrap	Bias		0	0.001	−0.001	0.000	0.001	0.001	0.000
		Std. error		0	0.022	0.026	0.032	0.033	0.017	0.023
		95% Confidence interval	Lower	1	−0.019	−0.212	−0.186	0.062	−0.022	−0.166
			Upper	1	0.064	−0.110	−0.059	0.191	0.043	−0.079

Note: **Correlation is significant at the 0.01 level (2-tailed), c. Unless otherwise noted, bootstrap results are based on 1000 bootstrap samples.

example, pregnant women who never attended ANC had the highest incidence of BBA (22.5%), while the group that had nine or more ANC visits had the lowest rate (2.3%). Maternal illnesses significantly affected pregnancy; mothers with HIV and syphilis infections had higher BBA rates of 6.4% and 11.1%, respectively, than mothers without HIV (3.7%, $p < 0.001$) and syphilis (4.6%, $p = 0.007$). Newborns with LBW (less than 2.5 kg) and preterm delivery (less than 37 weeks gestational age) exhibited substantially differing BBA rates. For instance, the percentage of BBA in preterm births was greater of 8.3% than in term births of 3.4% ($p < 0.001$), while the percentage of BBA was much lower (3.9%) in the non BBA group than in the BBA of 12.6% ($p < 0.001$). BBA rates were substantially greater among women who had still births (26.7% negative) than their counter part ($p < 0.001$) and similarly BBA rate was lower of 4.4% of all live birth than 25.4% of those who did not have ($p < 0.001$), indicating significant links between stillbirths and live births on BBAs.

4.1. Consequences and Correlation of BBA on Pregnancy Outcomes

The effects of BBA on maternal and perinatal outcomes are also displayed in Tables II and III. Just three (1.5%) of the 196 BBAs, for instance, had PPH, compared to 193 (0.8%) of the 3914 women in the non-BBA group ($p > 0.05$). In a similar vein, the BBA group's stillbirth rate of 8.2% is significantly greater than that of the non-BBA group, which is (1.1%, $p < 0.001$). Additionally, BBA was substantially linked to LBW and preterm deliveries. 94/1139 (8.2%) of term deliveries are higher than 102/2924 (3.4%) of preterm deliveries among the 196 BBAs ($p < 0.001$). It is discovered that the rate of LBW is higher in BBA women (52/414, 12.5%) than in non-BBA women (144/3699, 3.8%). BBA did not, however, substantially correlate with maternal PPH or ENND ($p > 0.05$). In summary, the BBA group had significantly higher rates of stillbirth (8.2%), PTB birth (8.3%), and LBW delivery (12.6%) ($p < 0.05$).

Correlation using data from 4108 instances, BBA and maternal and neonatal health outcomes, such as PPH, PTB, Live Births, Stillbirths, ENNDs, and LBW were conducted. Accordingly, there are negative correlation between BBA and PTB (−0.157), LBW (−0.122), and live birth rate (−0.121). This suggests that infants born prior to arrival typically have lower birth weights, lower PTBs, and somewhat lower live birth rates. Although there was no significant link between BBA cases and either postpartum hemorrhage or early neonatal mortality, a positive correlation with stillbirths (0.125) indicates a slightly greater risk of stillbirth.

4.2. Identification of Risk Factors for BBA

The logistic regression output (Table IV) shows that parity is strongly associated with BBA. As the parity of women are lower, the chances of BBA are lower too. For example, women with nil parity are 95% (OR = 0.054, 95% CI; 0.021:0.140, $p < 0.001$), parity 1–2, 84% (OR = 0.164, 95% CI; 0.076:0.350, $p < 0.001$) and parity 3–4 (OR = 0.27, 95% CI; 0.12:0.60, $p = 0.001$) 74% less likely to have BBA than those women who had parity 5 or more. Similarly, women who are having ANC at KCHC shows lower OR of 0.63 (95% CI; 0.44:0.91, $p = 0.014$) compared to having ANC at other health facility. On the contrary, women who are having ANC visit 0 shows a higher OR of 3.41 (95% CI; 1.205:9.66, $p = 0.021$) compared to women having 9 or more ANC visits. Preterm and LBW deliveries are also associated with higher chances of BBA. The ORs for Preterm delivery are 1.53 (95% CI; 1.05:2.22, $p = 0.024$) and 2.41 (95% CI: 1.53:3.79, $p < 0.001$), respectively.

5. Discussion

This study included all women who delivered at KCHC and BBA mothers attended for care for them and their neonates between 2018 and 2022. Given the socioeconomic status of the catchment population, it is assumed that most deliveries occur at KCHC because it is the only medical institution in the area specifically dedicated to maternity care. Some may have had access to private facilities outside of the catchment region, though. This study did not include all pregnant women because high-risk pregnant patients were also referred to hospitals. The behavioral element of women was not evaluated. Abortions, maternal deaths, and intensive care unit admissions were not reported in the study. These figures, however, contained a great deal of delivery data from the residents of the townships of Clermont and Kwadabeka during a five-year period, which may be useful for trend analysis and comparison. Almost all, 97% of pregnant women had at least one ANC visit in a health facility, and 96% delivered in a facility with a skilled birth attendant, according to the most recent SADHS data [5]. However, the percentage of expectant

TABLE IV: Logistic Regression Output for BBA

Exposure variables for BBA	P values	OR	95% CI for OR	
Variables			Lower	Upper
Age	0.181			
Teenage (14–19 years)	0.205	2.608	0.591	11.504
20–29 years	0.622	1.410	0.360	5.523
30–39 years	0.402	1.770	0.465	6.740
Parity	0.000			
Nil (0)	<0.001	0.054	0.021	0.140
1–2	<0.001	0.163	0.076	0.350
3–4	0.001	0.276	0.125	0.605
Preterm (<37 weeks) delivery	0.024	1.533	1.059	2.220
Low birth weight (<2.5 kgs)	<0.001	2.413	1.534	3.795
ANC facility KCHC	0.014	0.637	0.445	0.912
ANC booking before 20 weeks of GA	0.191	1.288	0.881	1.883
Syphilis status negative	0.166	0.553	0.239	1.277
HIV status-negative	0.065	0.716	0.502	1.021
Number of ANC visit	0.141			
ANC visit (0)	0.021	3.412	1.205	9.667
ANC visit (1–2)	0.075	1.971	0.933	4.162
ANC visit (3–4)	0.529	1.249	0.625	2.495
ANC visit (5–6)	0.218	1.491	0.790	2.811
ANC visit (7–8)	0.626	1.179	0.609	2.281
Constant	0.999	13896.794		

Note: Variable(s) entered on step 1: Age, parity, ANC facility, Booked for ANC, Booking before 20 weeks gestational age, Numbers of ANC visits, Syphilis and HIV status, Live birth, Still birth, Early neonatal death, GA at delivery and Birth weight.
Comparison group: ANC at other health facility, ANC initiation after 20 weeks of GA, ANC visit >9 age >40 years, HIV and syphilis status positive.

women in our area who gave birth at KCHC and outside remained unclear or unknown. However, the residence lives close by to KCHC, lower socioeconomic status of the catchment population, free maternity healthcare in South African public health facilities, and policies are in place to encourage pregnant women to use public health facilities, one could expect a higher health service utilization rate by the target population. However, the retrospective review of birth registrations led to information bias, which further limited the study variables' availability. For instance, cultural practices and the socioeconomic status of expectant mothers—those are known risk factors for BBA—were not included in the birth register [29]–[31].

A nation's BBA rate is a measure of how easily accessible perinatal care is, and a rate of more than 1.5% is typically viewed as undesirable [42]. Our study's average BBA rate is 4.8%, with yearly rates dropping sharply from 6.4% in 2019 to a lower rate of 3.8%. This is a higher prevalence in the study area since the BBA rate is a measure of access to perinatal care, and a rate higher than 1.5% indicates difficulties in the delivery of healthcare, for which suitable solutions are necessary [42]. Our study's rate, however, is comparable to the previous report from a MOU of another SA province [12]. The falling trend of BBA rate in our facility is good. Ethiopia also observed a similar downward trend. 15% in 2024, down from a higher rate of 50% in 2014 [1], [11]. There are a number of potential causes for this drop in our study, including i) better access to healthcare for mothers and ii) outside influences such the COVID-19 epidemic in SA during 2020 to 2022. The implementation of Community Healthcare Workers (CHWs) in the community to address chronic illnesses and provide household-level maternal and pediatric healthcare.

In low- and middle-income nations where there are shortages of professional health workers, community health workers (CHWs) are commonly used as part of the health system to offer health care to mothers and children in their homes. In general, CHWs are community members who are selected by their community and serve in their community to deliver culturally competent health care [43]. According to a Rural KZN report, CHWs gave expectant moms accurate and pertinent health information. Mothers were pleased with CHW visits and appreciated that the CHWs were aware of their life experiences and could therefore offer them accessible and pertinent guidance and assistance [44]. The educational intervention from the midwife to ANC users on identification of labor pain, planning for selected health facility delivery and educating pregnant women on the adverse effects of BBAs are some [44]. For instance, unattended births at home and while traveling to the hospital accounted for 3.2% of BBAs in the Maribor region of Slovenia [45]. With an average rate of 4.2% from 1992 to 2011, the tendency is also noticeable in Australia [45]. The BBA rates are seen to steadily rising in SA; for instance, it was 5.4% in 2009 [1] and 10% in 2013 [46], compared to 5.7% in KwaZulu-Natal, 5% in Gauteng [1] and 4.6% from Nkangala District of South Africa [12]. Therefore, our study's BBA rate of 4.8% is in line with recent findings from SA and other sources [4], [46].

Potential obstetric predictors, such as women's parity, showed that women with parity nil or primigravid were 95% (OR = 0.054) less likely to have BBA than women with parity 1–2, 84% (OR = 0.164), and parity 3–4, 74% (OR =

0.63) less likely to have BBA than women with parity five or more. Therefore, women who are great multiparous—that is, have five or more pregnancies—are more likely to have BBA. Grand multiparity, defined as having five or more prior births, was nearly nine times more likely to have BBA [40], according to a prior study. Compared to their primigravid or lesser multigravida counterparts, grand multigravidas (parity >5) may be more likely to experience more abrupt labor. This is in line with earlier research that shown that BBA is linked to low maternal age, low education, poor transportation access, and multiparty were linked to a shorter second stage of labor [4], [42]. It is commonly accepted that lowering the prevalence of BBA and guaranteeing expert attention throughout pregnancy and delivery are essential to lowering perinatal adverse outcomes, such as stillbirths and neonatal deaths [47]. The staffing of MOU and PHC clinics in the KCHC catchment area may have contributed to the reduced OR of 0.63 for women who received ANC at KCHC as opposed to women who received ANC at other medical facilities for BBAs. Midwives are not employed by PHC facilities to provide maternity care. Basic ANC is provided by PHC-trained nurses on maternity care who might not be proficient in health education to encourage expectant mothers to stay away from the occurrence of BBAs (47).

In our PHC setup, we discovered that women without ANC were at risk for BBA (OR = 3.4) due to their close proximity to the catchment population. Compared to 40.3% of moms who were hospitalized for delivery, 78.0% of BBA mothers did not attend ANC, according to a Kenyan study [48]. Ethiopia and Kenya showed a comparable degree of correlation between BBA and not receiving prenatal care (AOR = 2.6) [11], [48]. Moreover, a study discovered that fewer than or equivalent to four ANC visits was a risk factor for premature labor and preterm birth, which frequently result in BBA [49]. A midwife and the patient who will give birth to the mother when she presents in labor may get along well if there are more ANC interactions. Higher odds of BBA were also linked to preterm and LBW newborns. The odds ratios for preterm and LBW deliveries are, respectively, 1.53 and 2.41. BBAs are more likely to occur in preterm and LBW infants due to precipitated labor [49]. Additionally, BBAs were observed to have a low birth weight and a substantial risk of preterm, which is consistent with other study findings [13].

6. Conclussion

According to the survey, the prevalence of BBA is trending downward. These results emphasize how crucial early ANC scheduling and sufficient ANC visits are to lowering BBA and enhancing pregnancy outcomes. Prematurity and low birth weight are major consequences of BBAs. BBA is something that can be avoided. Future studies should examine the behavioral and socioeconomic characteristics of service consumers and healthcare professionals that affect BBAs' ability to create more successful intervention plans.

Authors' Contributions

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

MH: conceptualized research idea, data collection, analysis and participated in manuscript write-up.

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

MA: Conceptualization and write up and finalization of the manuscript.

AMA: Conceptualization, preparing draft and finalization of the manuscript.

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

Conflict of Interest

The authors declare no competing interest.

References

[1] Parag N, McKerrow NH, Naby F. Profile of babies born before arrival at hospital in a peri-urban setting. *South Afr J Child Health*. 2014;8(2):45–53. doi: 10.7196/sajch.681.

[2] Wanyoike PK, Mutua FM. Factors associated with born before arrival and birth outcome among postnatal women attending Irchagadera Hospital, Garissa County, Kenya. *Int Arch Public Health Community Med*. 2020;4:51.

[3] Nganjo Phiri S, Fylkesnes K, Ruano AL, Moland KM. 'Born before arrival': user and provider perspectives on health facility childbirths in Kapiri Mposhi district, Zambia. *BMC Pregnancy Childbirth*. 2014;14:323. doi: 10.1186/1471-2393-14-323.

[4] Khupakonke S, Beke A, Amoko DHA. Maternal characteristics and birth outcomes resulting from births before arrival at health facilities in Nkangala District, South Africa: a case-control study. *BMC Pregnancy Childbirth*. 2017;17:401. doi: 10.1186/s12884-017-1580-5.

[5] National Department of Health (NDoH), Statistics South Africa (Stats SA), South African Medical Research Council (SAMRC), ICF. *South African Demographic and Health Survey 2016: Key Findings*. Pretoria (SA) and Rockville (MD): NDoH, Stats SA, SAMRC, ICF; 2018.

[6] Javaudin F, Hamel V, Legrand A, Goddet S, Templier F, Potiron C, *et al.* Unplanned out-of-hospital birth and risk factors of adverse perinatal outcome: findings from a prospective cohort. *Scand J Trauma Resusc Emerg Med*. 2019;27(1):1–7. doi: 10.1186/s13049-019-0600-z.

[7] Ovaskainen K, Ojala R, Gissler M, Luukkaala T, Tammela O. Out-of-hospital deliveries have risen involving greater neonatal morbidity: risk factors in out-of-hospital deliveries in one university hospital region in Finland. *Acta Paediatr*. 2015;104:1248–52. doi: 10.1111/apa.13117.

[8] McLelland G, McKenna L, Archer F. No fixed place of birth: unplanned BBAs in Victoria, Australia. *Midwifery*. 2013;29:e19–25. doi: 10.1016/j.midw.2011.12.002.

[9] Alabi AA, O'Mahony D, Wright G, Ntsaba MJ. Why are babies born before arrival at health facilities in King Sabata Dalindyebo Local Municipality, Eastern Cape, South Africa? A qualitative study. *Afr J Prim Health Care Fam Med*. 2015;7(1):1–9. doi: 10.4102/phcfm.v7i1.881.

[10] Ethiopian Public Health Institute (EPHI) [Ethiopia], ICF. Ethiopia Mini Demographic and Health Survey 2019: Final Report. Rockville (MD): EPHI and ICF; 2021. Available from: https://dhsprogram.com/publications/publication-FR363-DHS-Final-Reports.cfm.

[11] Amanuel T, Desalegn M, Lukas K, Yohannes T. Prevalence of birth before arrival and associated factors among postpartum women in southern Ethiopia: a community-based cross-sectional study. *Front Med*. 2024;11:1437538. doi: 10.3389/fmed.2024.1437538.

[12] Khupakonke S, Beke A, Amoko DHA. Maternal characteristics and birth outcomes resulting from births before arrival at health facilities in Nkangala District, South Africa: a case-control study. *BMC Pregnancy Childbirth*. 2017;17:401. doi: 10.1186/s12884-017-1580-5.

[13] Jenneker M, Maharaj NR. Perinatal outcomes in babies born before arrival at Prince Mshiyeni Memorial Hospital in Durban, South Africa. *Obstet Gynecol Int*. 2022;2022:2316490.
[14] Pattinson R, Rhoda N. *Saving Babies Report 2012–2013: Ninth Report on Perinatal Care in South Africa*. Pretoria: Tshepesa Press; 2014.
[15] Velaphi S, Rhoda N. Reducing neonatal deaths in South Africa—are we there yet and what can be done? *S Afr J Child Health*. 2012;6:67–71.
[16] United Nations Sustainable Development Goals. United Nations, New York, NY, USA. 2015. Available from: https://sustainabledevelopment.un.org/sdgs.
[17] Beeram M, Solarin K, Young M, Abedin M. Morbidity and mortality of infants born before arrival at the hospital. *Clin Pediatr (Phila)*. 1995;34(6):313–6.
[18] Di Benedetto MR, Piazze JJ, Unfer V, Cosmi EV, Montagnani G, Bianchi P, *et al.* An obstetric and neonatal study on unplanned deliveries before arrival at hospital. *Clin Exp Obstet Gynecol*. 1996;23(2):108–11.
[19] Bateman DA, O'Bryan L, Nicholas SW, Heagarty MC. Outcome of unattended out-of-hospital births in Harlem. *Arch Pediatr Adolesc Med*. 1994;148(2):147–52.
[20] Ballot DE, Chirwa TF, Cooper PA. Determinants of survival in very low birth weight neonates in a public sector hospital in Johannesburg. *BMC Pediatr*. 2010;10:30.
[21] Chaudhary P. Accidental out-of-hospital deliveries: factors influencing delay in arrival to maternity hospital. *Kathmandu Univ Med J (KUMJ)*. 2005;3:115–22.
[22] Chiragdin T. *Effect of Giving Birth Before Arrival (BBA) on Pregnancy Outcome Among Booked Mothers at Coast Provincial and General Hospital (CPGH)*. Nairobi: University of Nairobi; 2013.
[23] Nguyen ML, Lefèvre P, Dreyfus M. Maternal and neonatal outcomes of unplanned deliveries. *J Gynecol Obstet Biol Reprod (Paris)*. 2015;45:86–91. doi: 10.1016/j.jgyn.2015.02.002.
[24] Girsen AI, Mayo JA, Lyell DJ, Blumenfeld YJ, Stevenson DK, El-Sayed YY, *et al.* Out-of-hospital births in California 1991–2011. *J Perinatol*. 2018;38:41–5. doi: 10.1038/jp.2017.156.
[25] Lawn JE, Cousens S, Zupan J. 4 Million Neonatal deaths: when? Where? Why? *Lancet*. 2015;365:891–900.
[26] World Health Organization (WHO). Neonatal and perinatal mortality: country, regional and global estimates. *World Health Organ*. 2019;16:145–200.
[27] Thornton CE, Dahlen HG. Born before arrival in NSW, Australia (2000–2011): a linked population data study of incidence, location, associated factors and maternal and neonatal outcomes. *BMJ Open*. 2018;8:1–8.
[28] World Health Organization (WHO), United Nations Children's Fund (UNICEF). Survive and thrive: transforming care for every small and sick newborn. *World Health Organ Lib*. Geneva: WHO; 2019. p. 1–136. Available from: https://www.who.int/publications/i/item/9789241515887.
[29] Ovaskainen K, Ojala R, Gissler M, Luukkaala T, Tammela O. Out-of-hospital deliveries have risen involving greater neonatal morbidity. *Acta Paediatr*. 2015;104:1248–52.
[30] Ovaskainen K, Ojala R, Tihtonen K, Gissler M, Luukkaala T, Tammela O. Unplanned out-of-hospital deliveries in Finland: a national register study on incidence, characteristics, and maternal and infant outcomes. *Acta Obstet Gynecol Scand*. 2020;99:1691–9.
[31] Combier E, Roussot A, Chabernaud JL, Cottenet J, Rozenberg P, Quantin C. Out-of-maternity deliveries in France: a nationwide population-based study. *PLoS One*. 2020;15:e0228785.
[32] Marmot M, Friel S, Bell R, Houweling TA, Taylor S. Closing the gap in a generation: health equity through action on the social determinants of health. *Lancet*. 2008;372:1661–9.
[33] Sheiner E, Hershkovitz R, Shoham-Vardi I, Erez O, Hadar A, Mazor M. Accidental out-of-hospital delivery as an independent risk factor for perinatal mortality. *Arch Gynecol Obstet*. 2004;269:85–8.
[34] National Maternity Review. Better births: improving outcomes of maternity services in England [Internet]. Available from: https://www.england.nhs.uk/wp-content/uploads/2016/02/national-maternity-review-report.pdf.
[35] Thornton CE, Dahlen HG. Born before arrival in NSW, Australia (2000–2011): a linked population data study of incidence, location, associated factors, and maternal and neonatal outcomes. *BMJ Open*. 2018;8:e019328. doi: 10.1136/bmjopen-2017-019328.
[36] UNICEF. *The State of the World's Children 2009: Maternal and Newborn Health*. vol. 9. New York: UNICEF; 2008.
[37] Mazalale J, Kambala C, Brenner S, Chinkhumba J, Lohmann J, Mathanga DP, *et al.* Factors associated with delivery outside a health facility: cross-sectional study in rural Malawi. *Trop Med Int Health*. 2015;20:617–26. doi: 10.1111/tmi.12473.
[38] Mbogo JM. Risk factors associated with born before arrival and birth outcome among postnatal women in Tharaka Nithi County, Kenya [master's thesis]. Nairobi: Kenyatta University; 2018. Available from: https://ir-library.ku.ac.ke/handle/123456789/18927.
[39] Bhoopalam PS, Watkinson M. Babies born before arrival at hospital. *BJOG: An Int J Obstet Gynaecol*. 1991;98(1):57–64.
[40] Hubble TR, Nair M, Christina YL, Aye M, Mathewlynn S, Greenwood C, *et al.* Early antenatal risk factors for births before arrival: an unmatched case-control study. *Acta Obstet Gynecol Scand*. 2024;103:294–303. doi: 10.1111/aogs.14720.
[41] National Department of Health (NDoH). *Guidelines for Maternity Care in South Africa: A Manual for Clinics, Community Health Centres, and District Hospitals*. 4th ed. Pretoria, South Africa; 2016.
[42] Potter PC, Pelteret R, Reynolds L, Motala A, Kibel MA. Born before arrival: a study at the new Somerset Hospital, Cape Town. *South Afr Med J*. 1984;66:377–80.
[43] Olaniran A, Smith H, Unkels R, Bar-Zeev S, van den Broek N. Who is a community health worker?-A systematic review of definitions. *Glob Health Action*. 2017;10(1):1272223.
[44] Wilford A, Phakathi S, Haskins L, Jama NA, Mntambo N, Horwood C. Exploring the care provided to mothers and children by community health workers in South Africa: missed opportunities to provide comprehensive care. 2018;18(1):171. doi: 10.1186/s12889-018-5056-y.
[45] Lazić Z, Takač I. Outcomes and risk factors for unplanned delivery at home and before arrival at the hospital. *Cent Eur J Med*. 2011;123:11–4. doi: 10.1007/s00508-010-1505-z.
[46] Alabi AA, O'Mahony D, Wright G, Ntsaba MJ. Why are babies born before arrival at health facilities in King Sabata Dalindyebo Local Municipality, Eastern Cape, South Africa? A qualitative study. *Afr J Prim Health Care Fam Med*. 2015;7(1):1–9. doi: 10.4102/phcfm.v7i1.881.
[47] Kerber KJ, de Graft-Johnson JE, Bhutta ZA, Okong P, Starrs A, Lawn JE. Continuum of care for maternal, newborn, and child health: from slogan to service delivery. *Lancet*. 2007;370(9595):1358–69.
[48] Wanyoike PK, Mutua FM. Factors associated with born before arrival and birth outcome among postnatal women attending Irchagadera Hospital, Garissa County, Kenya. *Int Arch Public Health Community Med*. 2020;4:051. doi: 10.23937/2643-4512/1710051.
[49] Kaewkiattikun K. Birth before arrival at Faculty of Medicine Vajira Hospital. *Vajira Med J*. 2018;62(4):267–80. doi: 10.14456/vmj.2018.32.