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*Original Article*

# Adverse Birth Outcomes in Kenya: Prevalence and Key Health-Related Predictive Factors- A Cross-Sectional Analysis of KDHS 2022 Data

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*Adverse Birth Outcomes, Kenya, KDHS 2022, Neonatal Mortality, Low Birth Weight, Preterm, Stillbirth.*

## ABSTRACT

**Background:** Adverse birth outcomes (ABOs) including low birth weight, stillbirths, and early neonatal deaths remain a major public health concern in Kenya, contributing significantly to maternal and child morbidity and mortality. This study aimed to assess the prevalence and health-related predictors of ABOs using data from the 2022 Kenya Demographic and Health Survey (KDHS). **Methods:** A cross-sectional analysis was conducted using data from 17476 women aged 15–49 who had given birth in the five years preceding the survey. Adverse Birth Outcomes were defined as any occurrence of low birth weight, stillbirth, or early neonatal death. Statistical analyses included descriptive, bivariate, and multivariable binary logistic regression using SPSS version 28, accounting for sampling weights and survey design. Adjusted odds ratios (AORs) with 95% confidence intervals (CIs) were used to identify significant predictors. **Results:** The prevalence of Adverse Birth Outcomes was 11.1% which was contributed by 8% of preterm babies, 2.3% Low Birth Weight and 2.0% Neonatal Births. The key health-related factors that predict Adverse Birth Outcomes included number of ANC visits {with higher odds to those who scheduled ANC visits(≥8) (AOR = 2.947; 95% CI: 1.734–5.006), compared to women who had less than three visits}, timing of the first ANC visits {delaying the first ANC visit until after the first trimester resulted in lower odds of Adverse Birth Outcomes (ABOs) – AOR: 0.673; 95% CI: 0.412–0.729}, and parity/birth order{Multiparity exerted a protective effect among multiparous women showing decreased odds of adverse outcomes compared with primiparous women-AOR = 0.507; 95% CI: 0.461–0.559}. **Conclusions:** Adverse Birth Outcomes of over 10% of the population in Kenya remain a significant concern. Among the health-related factors that predict Adverse Birth Outcomes are the frequency of ANC visits (*a paradoxical finding that demonstates that ANC visits frequency is significantly associated with higher ABOs)*, the timing of initiation of ANC visits and parity, which should be the focus of implementing targeted interventions to improve birth outcomes.

 

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## INTRODUCTION

Adverse Birth Outcomes (ABOs) including preterm birth, low-weight births, stillbirths, and early neonatal deaths remain significant concerns across the world especially in lower- and middle-income countries. These ABOs not only lead to high rates of infant regrettable death and disability but also greatly impact a child's future growth, mental abilities, and even lead to chronic illnesses later in life (World Health Organization (WHO), 2021). According to Blencowe et al. (2016), more than fifty million infants were born early each year, alongside two point five million infants dying within twenty-eight days of their birth. UNICEF & World Health Organization (2019) also reported that over twenty million infants suffered from low-weight births, constituting almost fifteen percent of all births.

The overwhelming burden of ABOs in sub-Saharan Africa stems from a plethora of interconnected risk factors, including limited access to quality antenatal care (ANC), maternal under-nutrition, high rates of teenage pregnancy, alongside infectious diseases like malaria and HIV (Tamirat et al., 2021). Compounding these issues are fragile health systems and poor health-seeking behaviour driven by socioeconomic inequities. Even though there have been increased investments in the region's maternal and child healthcare services, progress toward reducing neonatal mortality and improving birth outcomes continues to be slow and uneven.

Kenya is one of the countries in sub-Saharan Africa which has positively advanced maternal and child healthcare services as compared to a decade ago. With Linda Mama free maternity services, the Beyond Zero campaign, and UHC pilot programs, there is increasing coverage of ANC appointments as well as skilled deliveries (Ministry of Health [MOH], 2022). The 2022 Kenya Demographic and Health Survey, released by KNBS, reported that over 85% of women have at least one ANC visit, while approximately 70% of births are facility-based (KNBS & ICF, 2023). Advancements noted above are progress towards universal health goals, but are still inadequate concerning the high rates of negative birth outcomes. According to KDHS 2022, Kenya's neonatal mortality rate remains at 20 deaths per 1,000 live births, alongside persistent regional and socioeconomic inequalities within the skewed distribution of birth outcomes (KNBS and ICF, 2023)

The literature identifies several Health-related factors associated with ABOs including ANC interventions, maternal age, parity, inter-pregnancy intervals, nutrition, and chronic or pregnancy-

 

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related conditions (Alemu et al., 2025). ANC still serves as one of the most important interventions in preventing and managing high-risk pregnancies. The WHO suggests at least eight contact sessions in the span of a single pregnancy to improve associated maternal and perinatal outcomes, with initiation during the first trimester being critical (World Health Organization (WHO), 2016). However, some emerging studies contradict the assumption made on linear relationships between more visits and better outcomes. For example, high attendance is linked with higher odds of adverse outcomes in certain populations as a result of reverse causality, where overrepresentation of high-risk pregnancies drives frequent visit attendance (Gamberini et al., 2023).

Based on hospital studies from Kenya, the rate of preterm births is between 15.9% and 20.2%, which is higher compared to population-based estimates like the KDHS. These surveys tend to reflect more community-wide trends (Ajayi et al., 2025; Mirieri et al., 2024). Such differences are a result of selection bias, differing sources of data, and recall bias in survey reporting. Social stigma, alongside cultural silence around pregnancy loss and poor documentation also contributes to underreporting stillbirths and early neonatal deaths, complicating the issue of ABO prevalence (Blanc & Wardlaw, 2005).

While there has been some interest in researching adverse outcomes in pregnancies, very few studies at national revisit the ABOs' prevalence alongside modifiable health predictors like attendance and timing of ANC visits or maternal nutrition? Most existing research either relies on facility-based data which ignores the general population or merges results without considering health-related and socio-demographic factors that contribute to ABOs. Considering Kenya's geographically diverse maternal population with varying education levels, socio-economic classes, and access to care, scarcity or abundance of resources, an understanding of these health-related factors is imperative.

Thus, this research aims to use the KDHS 2022 data to estimate the prevalence of Adverse Birth Outcomes (ABOs) and identify critical health determinants in the Kenyan context, addressing gaps in previous literature. By controlling for socio-demographic variables, this study seeks to net the impact of maternal health behaviors and conditions on Adverse Birth Outcomes (ABOs). The results will be vital in guiding Kenya's policy and programmatic interventions aimed at advancing maternal-newborn health aligned with Vision 2030 and SDG targets 3.1 and 3.2.

## METHODS

### Study Design and Data Source

This study employed a cross-sectional analytical design, drawing on secondary data from the 2022 Kenya Demographic and Health Survey (KDHS). The KDHS is a nationally representative survey conducted by the Kenya National Bureau of Statistics (KNBS) in collaboration with ICF International. It uses a multistage stratified cluster sampling method to collect data on demographic and health indicators, including maternal and child health outcomes. For this study, data were extracted from the individual women's recode file (KEIR8AFL.SAV), which contains information from women aged 15–49 years.

### Study Population

The target population included all women aged 15–49 years who reported at least one live birth within five years prior to the survey. From this group, births with complete data on key variables such as birth outcome, birth weight, gestational age, and neonatal survival were selected for analysis. Cases with missing values on any of the main outcome or predictor variables were excluded.

### Study Variables

#### *Outcome Variable*

The primary dependent variable was Adverse Birth Outcome (ABO), which was defined as the

 

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occurrence of any of the following in the most recent birth:

- Preterm birth (gestational age < 37 weeks)
- Low birth weight (< 2,500 grams)
- Neonatal death (death within 28 days of life)

This variable was recoded as binary in SPSS (0 = No ABO, 1 = Any ABO).

***Independent Variables***

The key health-related predictor variables included:

- Antenatal Care (ANC) visit frequency (categorised as: <3 visits, 4–7 visits, ≥8 visits)
- Timing of first ANC visit (first trimester vs. after first trimester)
- Parity/birth order (primiparous vs. multiparous)
- Place of delivery (home vs. facility)
- Maternal body mass index (BMI) (underweight, normal, overweight/obese)
- Birth interval (0-24, 25-59, ≥60 months)

Maternal/Socio-demographic control variables included:

- Maternal education level (no education, primary, secondary and above)
- Household wealth index (poor to rich quintiles)
- Place of residence (urban vs. rural)
- Religion (Christians vs others)
- Age (adolescents, optimal age, advanced age)
- Parity (low, medium, high)
- Partners' education (no education and primary vs secondary and above)

**Data Management and Analysis**

The data was imported into SPSS version 28 for cleaning, coding, and analysing. The following procedures were followed:

***1. Weighting***

In the KDHS dataset, sampling weights were provided. These were used to account for complex survey design using the variable v005 after making necessary adjustments by dividing by 1 million as per DHS guidance.

***2. Descriptive Statistics***

All categorical variables had their frequencies and percentages calculated. The prevalence of adverse birth outcomes was estimated during the study period and presented as a percentage of all live births in that timeframe.

***3. Bivariate Analysis***

Chi-square ($\chi^2$) tests were conducted to evaluate the relationship between ABO and each independent variable. Only those variables which had a p-value ≤0.05 in bivariate analysis were included in multivariable modelling.

***4. Binary Logistic Regression***

A hierarchical binary logistic regression model was constructed in two blocks to assess predictors of adverse birth outcomes. In Block 1 (Model 1), only maternal and socio-demographic variables were included to establish baseline associations. Block 2 (Model 2) added health-related variables to examine their net effect after controlling for maternal and socio-demographic factors. Both models utilised the "Enter" method in SPSS for analysis. Adjusted odds ratios (AORs) with corresponding 95% confidence intervals (CIs) were calculated and reported, with statistical significance determined at $p < 0.05$. Cases with missing values on key variables were excluded using list-wise deletion. This ensured analyses were based on complete data. Given the low proportion of missing values, its impact on findings was considered minimal.

 

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**Ethical Considerations**

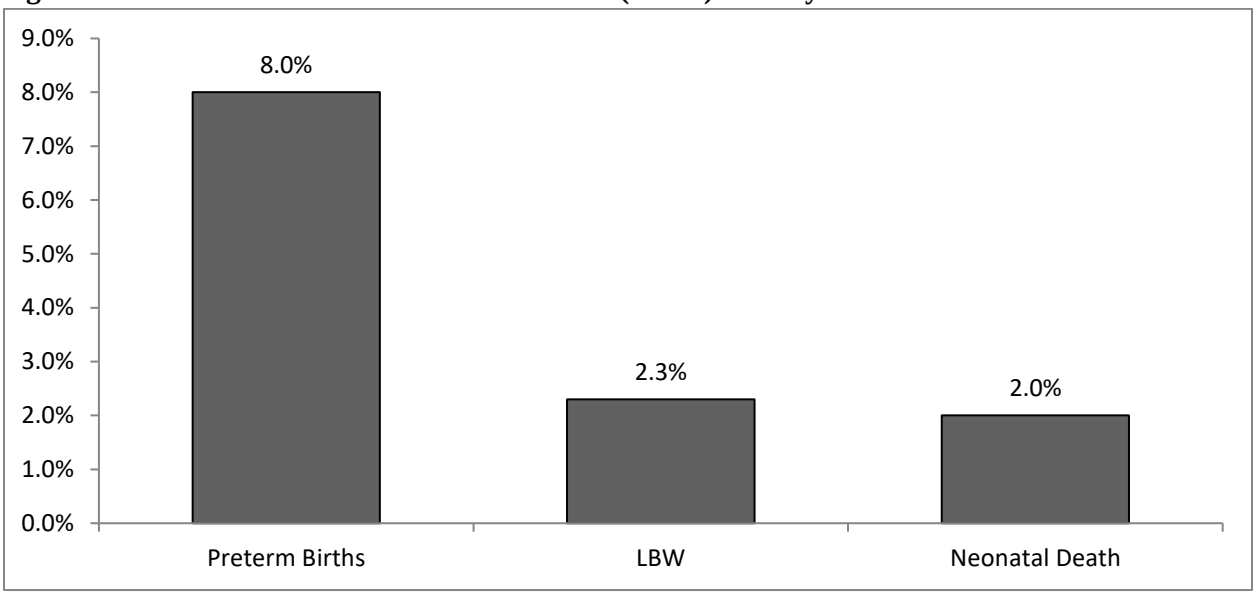
This study was based on a publicly available, de-identified dataset from the DHS Program. Ethical clearance for the original survey was obtained by KNBS and ICF International. Further ethical approval for secondary analysis was not required; however, permission to use the dataset was obtained from the DHS Program.

**RESULTS**

**Prevalence of Adverse Birth Outcomes (ABOs)**

Eleven and one-tenth percent (11.1 % (n=17476) of all the live births are Adverse Birth Outcomes (ABOs) in Kenya. The Adverse Birth Outcomes (ABOs) are a sum total of all the preterm births, Low Birth Weights and neonatal deaths. The preterm births were the majority with 8.0% (n=17476), followed by Low Birth Weight births at 2.3% (n=17476) and Neonatal deaths of 2.0% (n=17476) of all the live births as elucidated in Figure 1 below.

**Figure 1: The Profile of Adverse Birth Outcomes (ABOs) in Kenya**




**The Association of Maternal Characteristics and Adverse Birth Outcomes (ABOs)**

A Chi Square test was conducted to assess the association between selected maternal characteristics and Adverse Birth Outcomes (ABOs). The four maternal characteristics are age $\{X^2(2, n=17475) = 29.871, p<0.001\}$ maternal educational level $\{X^2(2, n=17475) = 118.485, p=0.008\}$, religion $\{X^2(2, n=17475) = 12.506, p=0.002\}$, and partner's education $\{X^2(2, n=17475) = 7.967, p=0.005\}$ were all significantly associated with Adverse Birth Outcomes (ABOs). The comprehensive details of association between maternal characteristics and Adverse Birth Outcomes (ABOs) are shown in the following Table 1.

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**Table 1: The Association between Maternal Characteristics and Adverse Birth Outcomes (ABOs)**

| Variable | Number of live births | Number Adverse Birth Outcomes (ABOs) (%) | $X^2$ | P value |
|---|---|---|---|---|
| **Age*** | | | | |
| Adolescents (15-19) | 817 | 180 (22.0) | 118.485[a] | .000 |
| Optimal Reproductive age (20-34) | 12917 | 1424 (11.0) | | |
| Advanced Maternal age (35-49) | 3741 | 3410 (8.8) | | |
| **Maternal Highest Education Level*** | | | | |
| No Education | 1795 | 131 (7.3) | 29.871[a] | .008 |
| Primary Educ' | 6630 | 743 (11.2) | | |
| ≥Secondary Educ' | 9050 | 1060 (11.7) | | |
| **Religion*** | | | | |
| Christianity | 15052 | 1673 (11.1) | 12.506[a] | .002 |
| Islam | 1675 | 156 (11.0) | | |
| Others | 749 | 106 (8.8) | | |
| **Type of place of residence** | | | | |
| Urban | 6534 | 757 (11.6) | 2.735[a] | .098 |
| Rural | 10943 | 1179 (10.8) | | |
| **Wealth quintile** | | | | |
| Poor | 7064 | 736 (10.4) | 5.643[a] | .060 |
| Middle | 3071 | 364 (11.9) | | |
| Rich | 7341 | 835 (11.4) | | |
| High (≥5) | 3595 | 304 (8.5) | | |
| **Partner's Educ*** | | | | |
| No Education & Primary Education | 6609 | 632 (9.6) | 7.967[a] | .005 |
| ≥Secondary Educ' | 7351 | 810 (10.0) | | |

**The Association of Health-related Factors and Adverse Birth Outcomes (ABOs)**

A Chi Square test was conducted to assess the association between selected health- related factors and Adverse Birth Outcomes (ABOs). The five health- related are the number of antenatal visits {$X^2$(2, n=10205)= 52.243, p<0.001} timing of initiation of antenatal visits{$X^2$(1, n=17469)= 16.235, p<0.001}, maternal BMI{$X^2$(2, n=9067)= 19.582, p<0.001}, parity/birth order{$X^2$(1, n=1934)= 194.858, p<0.001} and birth interval{$X^2$(2, n=12180)= 7.900, p=0.019} were all significantly associated with Adverse Birth Outcomes (ABOs). The comprehensive details of association between selected health- related factors and Adverse Birth Outcomes (ABOs) are shown in the following Table 2

 

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**Table 2: The Association between Health-related Factors and Adverse Birth Outcomes (ABOs)**

| Variable | Number of live births | Number of Adverse Birth Outcomes (ABOs) (%) | $X^2$ | P value |
|---|---|---|---|---|
| **ANC Visits*** | | | | |
| Inadequate (1-3) | 3820 | 401 (10.5) | 52.243 [a] | .000 |
| Adequate (4-7) | 5968 | 621 (10.4) | | |
| Optimal (≥8) | 417 | 89 (21.3) | | |
| **ANC Initiation Timing*** | | | | |
| Early (1-3) | 2866 | 379 (13.2) | 16.235 [a] | .000 |
| Late (≥4) | 14603 | 1554 (10.6) | | |
| **BMI*** | | | | |
| Underweight | 813 | 90 (11.1) | 19.582 [a] | .000 |
| Normal | 4796 | 654(13.6) | | |
| Overweight /Obese | 3458 | 364(10.5) | | |
| **Place of birth** | | | | |
| Facility | 9173 | 1204 (13.1) | 0.853 [a] | .356 |
| Non facility | 181 | 28 (15.5) | | |
| **Parity/ Birth Order*** | | | | |
| Primi-parous (1) | 5220 | 843 (16.2) | 194.858 [a] | .000 |
| Multi-parous (≥2) | 12246 | 1091(8.9) | | |
| **Birth Interval*** | | | | |
| Below 24 Months | 2084 | 208 (10.0) | 7.900 [a] | .019 |
| 25-59 Months | 6444 | 522 (8.1) | | |
| ≥60 months | 3652 | 332 (9.1) | | |

**The Predictive Health-related Factors of Adverse Birth Outcomes (ABOs)**

Binary logistic regression was conducted to examine the predictors of Adverse Birth Outcomes (ABOs). In Model 1, maternal characteristics were entered. In Model 2, health-related factors were added to assess their predictive value after controlling for maternal characteristics. After adjusting for maternal characteristics, several health-related factors were significantly associated with Adverse Birth Outcomes (ABOs) (Table 3).

Women who had optimal ANC visits (≥8 visits) had higher odds of experiencing an Adverse Birth Outcome (AOR = 2.947; 95% CI: 1.734 – 5.006), compared to those who had attended less than three visits. Late initiation of antenatal visits (after the first trimester) was also significantly associated with decreased odds of Adverse Birth Outcomes (ABOs) (AOR = 0.673; 95% CI: 0.412- 0.729). Parity/Birth order remained a significant predictor, with multiparous women showing lower odds for Adverse Birth Outcomes (ABOs) (AOR = 0.507; 95% CI: 0.461 – 0.559). The comprehensive details of association between selected health- related factors and Adverse Birth Outcomes (ABOs) upon controlling of maternal characteristics are shown in the following Table 3.

 

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**Table 3: Health-related Factors by Adverse Birth Outcomes (ABOs) and the Associated Adjusted Odds Ratio**

| Variable | Number of live births | Number of Adverse Outcomes (%) | Adjusted OR 95% CI |
|---|---|---|---|
| **ANC Visits*** | | | |
| Inadequate (1-3) | 3820 | 401 (10.5) | 1 |
| Adequate (4-7) | 5968 | 621 (10.4) | 0.548 (0.412 – 0.729) |
| Optimal (≥8) | 417 | 89 (21.3) | 2.947(1.734 – 5.006) |
| **ANC Initiation Timing*** | | | |
| Early (1-3) | 2866 | 379 (13.2) | 1 |
| Late (≥4) | 14603 | 1554 (10.6) | 0.673 (0.412- 0.729) |
| **BMI** | | | |
| Underweight | 813 | 90 (11.1) | 1 |
| Normal | 4796 | 654(13.6) | 1.124(0.685-1.846) |
| Overweight /Obese | 3458 | 364(10.5) | 0.8461(0.501-1.427) |
| **Place of birth** | | | |
| Facility | 9173 | 1204(13.1) | 1 |
| Non facility | 181 | 28 (15.5) | 1.395 (0.678- 2.871) |
| **Parity/Birth Order*** | | | |
| Primi-parous (1) | 5220 | 843 (16.2) | 1 |
| Multi-parous (≥2) | 12246 | 1091(8.9) | 0.507 (0.461 – 0.559) |
| **Birth Interval** | | | |
| Below 24 Months | 2084 | 208 (10.0) | 1 |
| 25-59 Months | 6444 | 522 (8.1) | 0.840 (0.596 – 1.183) |
| ≥60 months | 3652 | 332 (9.1) | 0.853(0.582 - 1.250) |

## DISCUSSION

### Prevalence and Profile of Adverse Birth Outcomes

The 11.1% prevalence rate is nearly consistent with the regional figure of approximately 12% in Sub-Saharan Africa for preterm births and small for gestational age outcomes (Mirieri et al., 2024). In Kenya, hospital-based studies reported preterm birth rates between 15.9-20.2%, indicating that community-based surveys like the KDHS tend to capture lower rates (Ajayi et al., 2025). Included in a Kenyan cohort study was Adverse Birth Outcomes (ABOs) such as stillbirths, preterm births, and congenital anomalies which led to an overall rate of 20.9%. This figure has been noted to be higher due to the inclusion criteria (Mirieri et al., 2024). From a national level, the KDHS figure further confirms that there is a substantial burden, along with a need justifying the ongoing mobile clinic interventions funded by the Kenyan Beyond Zero Initiative, Universal Health Care expansion and Enhanced Maternal Child Outreach Services.

The range of 7 to 12%, as observed in other low and middle-income countries, was also mirrored by the diagnosed rate from Blencowe et al. (2016) and World Health Organization (WHO) (2022), which estimate a preterm birth baseline of 8%. Wagura et al. (2018), however, prove a differing theory where older models based on Kenya hospitals projected

 

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these figures over high-risk populations, demonstrating up to fifteen to twenty percent margins on preterm numbers. The discrepancy may reflect selection bias, considering national survey data like KDHS would rely on maternal recall; As earlier discussed, weighted non-hospitalized versions often lead through a lack of regulated standards surrounding fact-pivoted ethical structures via maternal memory tools.

The LBW rate of 2.3% is much lower than the 5-7% recorded in previous rounds of the Kenyan DHS(KNBS and ICF, 2014), and is also significantly lower than global estimates of around 14.6% (UNICEF & World Health Organization, 2019). This could be due to birth weight data being only available for a subset of newborns delivered in health facilities, and mothers' inaccurate reporting from home births (Blanc & Wardlaw, 2005).

The neonatal mortality rate of 2.0% equals twenty deaths per one thousand live births, which aligns with the KDHS 2022 results (KNBS and ICF, 2023). Over the past decade, neonatal mortality has improved in Kenya, it continues to heavily drive under-five mortality rates. The principal factors contributing to neonatal deaths in the country are preterm birth complications, infections, and birth asphyxia (World Health Organization (WHO), 2021)

The sequence "preterm > LBW > neonatal death" conveys how greatly linked these outcomes are to one another. Preterm delivery strongly correlates with LBW, which subsequently leads to a greater risk of infant mortality. This data reveals that there is an immediate need to enhance antenatal care (ANC) tracking and scheduling for early ANC visits, improving maternal nutrition, as well as increasing institutional deliveries. Also tracked at the community level, Kangaroo Mother Care, alongside postnatal home visits, has mitigated neonatal morbidity and mortality significantly (World Health Organization (WHO), 2022)

**The Health-related Predictors of Adverse Birth Outcomes**

Optimal scheduled antenatal care (ANC) visits, defined as eight or more, were positively associated with adverse birth outcomes (ABOs), with women attending these visits having significantly higher odds (AOR = 2.947; 95% CI: 1.734–5.006) compared to those with fewer than three visits. Interestingly, initiating ANC after the first trimester was linked to lower odds of ABOs (AOR = 0.673; 95% CI: 0.412–0.729), suggesting that early initiation may not always reflect better outcomes, potentially due to underlying risk factors prompting early care. Additionally, multiparity demonstrated a protective effect, with multiparous women exhibiting decreased odds of experiencing ABOs (AOR = 0.507; 95% CI: 0.461–0.559).

Women who attended eight or more ANC visits had almost three times the odds of experiencing Adverse Birth Outcomes (ABOs) compared to women with two or less visits. This may reflect reverse causation, whereby women at greater risk (hypertension, diabetes, and fetal complications) are advised to attend more, thus increasing the apparent association. Community-based cohort studies in lower-income countries have documented similar trends where high-risk pregnancies necessitated increased visit frequency.

The association of late ANC initiation with lower risk (AOR = 0.673) is equally perplexing. This might be due to selection bias, where comparatively healthier women tend to start ANC later and possess low-risk pregnancies, which mirrors results documented in Ethiopia and Tanzania, where late booking was associated with lower-risk pregnancies.

A reduction in risk due to multiparity (AOR = 0.507) is well supported in the literature, suggesting that seasoned mothers have less complex and more successful pregnancies (Alemu et al., 2025). Other studies confirming the protective effects of parity

 

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also reported increased odds of adverse outcomes amongst first-time mothers (Tafere et al., 2025).

These counterintuitive associations suggest timing and frequency of ANC may be proxies for some underlying risk, rather than direct causes of the outcome.

**Limitations of the Study**

When understanding the study results, the following limitations should be kept in mind. To begin with, there is likely some reverse causation and confounding women with high-risk pregnancies may have greater need for antenatal care (ANC) visits due to elevated risk of complications, potentially amplifying the association between ANC attendance and adverse birth outcomes (ABOs). In addition, key socio-demographic factors aside, residual confounding from unmeasured clinical variables such as hypertension or diabetes in pregnancy, which could affect both ANC attendance and the likelihood of ABOs, could remain. Also of concern is that KDHS' cross-sectional design creates difficulties in substantiating temporality, raising the question of whether complications drove increased ANC visits or vice versa. Moreover, there is concern about recall and reporting bias since attendance at ANC and associated birth outcomes are documented by the participants themselves during interviews, which are prone to memory distortions, especially when recounting unpleasant events. Last but not least, this information, along with most of the other data, came from community surveys, which do not account for certain clinical events such as preterm stillbirths that are routinely recorded in hospital documents. This gap may lead to an underestimate concerning total ABOs resulting in underestimated prevalence rates.

## CONCLUSION

This research highlights the major impact of Adverse Birth Outcomes (ABOs) in Kenya. The highest contributor of ABOs was preterm births, followed by low birth weight and neonatal mortality. These trends underscore the outcome-dependent nature of these factors since preterm birth significantly predisposes an infant to both low birth weight and death in the neonatal period. Though KDHS and similar community-based surveys give a commendable glimpse towards the national picture, they tend to underestimate prevalence as compared to hospital-based studies because of poor capture of stillbirths, coupled with reliance on maternal recall.

The paradoxically higher frequency of ANC visits was linked to greater odds of adverse outcomes. This is likely due to heightened pregnancy risk requiring greater contact with care, instead of these visits being harmful due to inadequate care surrounding these appointments. In the same way, late initiation of ANC was connected with lower odds to ABOs, perhaps due to some form of bias wherein women waiting tend to be those at lower risk. It was noted that Multiparity conferred protection, which aligns with literature demonstrating increased vulnerability among first-time mothers.

The results emphasise how challenging it is to understand the indicators of antenatal care. The timing and frequency of ANC visits likely serve more as proxies for risk rather than being causal factors. In addition, maternal sociodemographic and clinical risk profiles seem to influence the patterns of care utilisation and the resultant outcomes in ways that go beyond what is captured in cross-sectional analyses. Further research employing longitudinal design is hereby suggested to succinctly examine the causality of health related factors on ABOs.

## RECOMMENDATIONS

To reduce adverse birth outcomes in Kenya, healthcare systems should enhance antenatal care (ANC) by integrating advanced risk profiling to tailor visit frequency based on individual needs rather than rigid benchmarks. Cognizant of the finding that late initiation of ANC was connected with lower odds to ABOs, public health messaging should emphasize early ANC initiation while

 

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avoiding the notion that more visits alone equate to better outcomes. Data systems must be strengthened to improve the capture of stillbirths and early neonatal deaths in both facility and community-linked surveys like the KDHS. Appreciating that this study confirmed the protective effects of parity also reported increased odds of adverse outcomes amongst first-time mothers. Therefore, targeted support for first-time mothers through mentorship and enhanced prenatal care can address their higher risk of adverse outcomes. Community-level newborn care, such as Kangaroo Mother Care, engagement of community health promoters, and domiciliary postnatal visits, should be expanded, especially in rural areas. Finally, further research is needed to explore how ANC visit frequency and specific clinical conditions like hypertension or infections during pregnancy impact birth outcomes, ideally through longitudinal studies.

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