THERAPEUTIC ADVANCES in
Reproductive Health

Original Research

Prevalence and determinants of preterm birth among women of reproductive age in Kenya: a multilevel analysis of the 2022 Demographic Health Survey

Ther Adv Reprod Health

2025, Vol. 19: 1–16

DOI: 10.1177/26334941251327181

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Abstract

Background: Globally, over 15 million preterm births (PTB) occur annually, with sub-Saharan Africa bearing a disproportionate burden. In Kenya, studies conducted between 2017 and 2021 at the hospital level show a PTB prevalence ranging from 15.9% to 20.2%. However, current PTB prevalence and associated factors remain underexplored despite their significant public health implications. Understanding the prevalence and factors associated with PTB is critical for effective interventions.

Objectives: This study aimed to determine the prevalence of PTB and also to identify individual- and community-level factors influencing PTB among women of reproductive age in Kenya.

Design: The study utilised a cross-sectional design, analysing data from the 2022 Kenya Demographic and Health Survey.

Methods: A sample of 7291 women aged 15–49 was analysed using weighted multilevel logistic regression in Stata 17.0. Adjusted odds ratios (aOR) with 95% confidence intervals (CI) and a significance threshold of $p < 0.05$ were used to identify predictors of PTB.

Results: The prevalence of PTB was 7.14%. Women aged 25–34 (aOR = 0.67; 95% CI: 0.49–0.94) and 35+ (aOR = 0.86; 95% CI: 0.59–1.24) were less likely to experience PTB compared to younger women (15–24 years). Attending four or more antenatal care visits reduced PTB likelihood (aOR = 0.68; 95% CI: 0.53–0.88). Women in the richest wealth index had higher odds of PTB (aOR = 2.28; 95% CI: 1.39–3.74), while medium community literacy levels increased PTB risk (aOR = 1.56; 95% CI: 1.21–2.03).

Conclusion: This study highlights that individual- and community-level factors significantly influence PTB in Kenya. Addressing disparities in socio-demographic and obstetric factors through targeted, multipronged strategies is essential for reducing PTB rates and improving maternal and neonatal outcomes.

Plain language summary

Preterm births in Kenya: how common are they and what factors contribute

Preterm birth (PTB) is when a baby is born before 37 weeks of pregnancy. It's a major public health issue, with over 15 million cases globally each year. Sub-Saharan Africa, including Kenya, has a high share of PTB, but there's limited research about it in Kenya. This study looked at how common PTB is in Kenya and what factors increase the risk. Using data from the 2022 Kenya Demographic and Health Survey, the authors analysed 7,291 women aged 15–49. They used statistical methods to find patterns and identify factors linked to

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PTB. The study found that 7.14% of women in the sample had a preterm birth. Younger women aged 15–24 were more likely to experience PTB compared to women aged 25–34 or 35 and older. Women who attended at least four antenatal care visits were less likely to have a preterm birth. Surprisingly, women from the richest households had a higher risk of PTB, and living in communities with medium levels of literacy also increased the risk. The findings show that both personal and community factors affect the chances of preterm birth. To reduce PTB rates, efforts should focus on improving access to antenatal care, addressing social and economic inequalities, and promoting education at the community level. These steps can help improve the health of mothers and babies in Kenya.

Keywords: KDHS, Kenya, maternal health, multilevel analysis, preterm birth, prevalence, sub-Saharan Africa

Received: 15 November 2024; revised manuscript accepted: 24 February 2025.

Introduction

Each year, more than 15 million preterm births (PTBs) occur before the completion of 37 weeks of pregnancy globally.[1,2] PTB is the leading cause of under-five mortality with substantial adverse short- and long-term health consequences for those who survive.[1,3,4] Despite its prevalence and health consequences, the direct causes of PTB remain unknown. However, research shows several multifaceted variables ranging from behavioural to health system factors associated with PTB.[5–12] Consequently, PTB leads to severe adverse emotional, financial and economic burdens for families, health systems and societies, especially in the low-setting areas globally.

While PTB is on the rise globally, the rates are disproportionately higher in sub-Saharan Africa (SSA), with 60% of PTBs occurring in this region, and over nine million (12.5%) births are estimated to be PTB.[1,11] Kenya, like many other East African countries in SSA, has astronomical rates of PTB, with over 12.3% of PTB occurring in 2010. Additionally, studies conducted between 2017 and 2021 at the hospital level show a PTB prevalence ranging from 15.9% to 20.2%.[13–15] Several underlying factors are associated with the high PTB rates in Kenya. For example, while there has been a steady decline in under-five mortality rates, in 2021, under-five mortality was 37.2 per 1000 live births in Kenya compared to the 25 deaths per 1000 live births recommended by the United Nations Sustainable Development Goals (SDG) by 2030 (goal 3, target 3.2).[16–18] These statistics are consistent despite the progress made in using antenatal care (ANC) visits and skilled birth workers in Kenya.[19–21]

Furthermore, other individual-level and behavioural factors, such as maternal age, high rates and poor knowledge of risky behaviours, socioeconomic status and residential area, are associated with poor maternal and neonatal health.[21–24] Moreover, other studies have found that health system issues, such as low quality of patient–provider relationships constituting mistreatment and disrespectful care, lead to adverse maternal and neonatal health.[25] Consequently, the literature suggests that poor quality of care available to women and children is a major determinant of high maternal and neonatal morbidity and mortality rates in Kenya.

However, similar to global studies,[1,5] research in Kenya on PTB has particularly found factors including urinary tract infections, history of abortion, alcohol consumption, history of PTB, pregnancy-induced hypertension, antepartum haemorrhage, prolonged pre-labour rupture of membranes, and multiple pregnancies to be strong predictors of PTB.[13–15] Despite the importance of these studies in expanding the knowledge of the burden of PTB in Kenya, they are limited in scope because they have mostly used hospital-level data, thus restricting the understanding of the true magnitude and estimates of PTB in the country to equitably protect and improve maternal and neonatal health towards achieving the SDG goals.

Given the enormous burden of PTB, it is essential to understand the pattern and multilevel factors associated with PTB using nationally representative data to develop evidence-based solutions and allocate resources equitably for the survival of mothers and infants. This study utilises the 2022 Kenya Demographic Health Survey (KDHS) to (1) estimate the prevalence of PTB and (2) measure the multilevel factors within the individual and community levels associated with PTB in Kenya. Given that Kenya incorporates key elements of the World Health Organisation (WHO) recommendation (i.e., antenatal corticosteroids, tocolytics, magnesium sulfate, kangaroo mother care, and surfactant) for improved PTB outcomes in its clinical standards of preterm care at the hospital level, this study is a call to action for stakeholders to amplify[26] efforts towards ensuring that these recommendations are adequately implemented across the country. As efforts to accelerate strategies to prevent adverse maternal and infant outcomes continue to be a priority in Kenya, this study offers policy and practice implications to advance maternal and neonatal health in Kenya in that while most of the existing studies on PTB in Kenya rely on hospital-based data, which primarily capture cases in healthcare facilities, they may fail to represent the broader population, particularly those with limited access to healthcare.[19–21] This study advances knowledge by leveraging nationally representative data from the 2022 KDHS, providing a comprehensive understanding of PTB prevalence and its determinants at both individual and community levels. By incorporating community-level predictors, such as literacy levels, and analysing wealth disparities, this study moves beyond clinical settings to capture the sociocultural and systemic factors influencing PTB. The findings offer a broader perspective, addressing population-level disparities often overlooked in hospital-based studies and providing actionable insights for targeted interventions across diverse Kenyan communities.

Methods

Study design and participants

This cross-sectional study involved secondary data analysis from the 2022 KDHS, the seventh installment of the Demographic and Health Survey (DHS) in Kenya. The Kenya National Bureau of Statistics implemented the survey in collaboration with the Ministry of Health and others. The DHS primarily asks questions regarding participants' socio-demographic characteristics, maternal and child health, and other sexual and reproductive health-related indicators, such as HIV/STI testing, family planning use, abortion, intimate and sexual partner violence, etc., were asked from women aged 15–49 years using a questionnaire survey design.[27] The DHS involves a two-stage sampling procedure consisting of a primary survey unit from which participants are randomly selected from clusters in each country included in this study.[27,28] Specifically, the birth recode (BR) file of the KDHS was analysed and publicly available for free upon request at the DHS website.

Study variables

Outcome variable. The outcome variable in this study is PTB among reproductive-aged women who had given birth within five years preceding the surveys. Similar to Alamneh et al.,[5] we derived the variable from the DHS question on the 'duration of pregnancy'. Duration of pregnancy was dichotomised as 'Yes' for PTB if it ranged or delivery was given between 4 and 8 completed months of gestational age, and 'No' if it ranged or birth was given after nine or more completed months of gestational age.

Explanatory variables. There are a total of 16 explanatory variables considered in this study based on previous literature and theoretical significance on the topic and availability of the variables of interest in the datasets, and these variables are subdivided into two broad categories of individual variables and household/community-level variables.[5,29] The individual-level variables include the mother's age (15–24, 25–34, and 35+), the woman and their partner's highest education level, including no education, primary, secondary, and higher. Household wealth index: poorest, poorest, middle, richer and richest. Other variables are marital status (married and living with a partner), employment status (Yes vs. No), birth interval (25+ months and ⩽24 months), the number of ANC visits during pregnancy (0–4 and 4–15), multiple pregnancies in the inter-survey period (Yes vs. No); sex of foetus (Male or Female); type of place of delivery (health facility or non-health facility); and history of pregnancy termination (Yes vs. No). The next group of variables is household and community-level variables, including the type of residence (urban vs. rural) and sex of the head of the household (male vs. female). Community-level literacy and poverty were developed from the variables on educational level and household wealth index, with three categories of low, medium and high being developed. All cofounders or explanatory variables were determined based on their relationship with the outcome variable.[5,29]

Statistical analyses

The data analysis started with a descriptive analysis table to show the level of PTB and distribution of all study variables; after this, the chi-square test of independence (χ^2) was used to indicate the association between PTB and the explanatory variables (see Table 1). All analyses (descriptive and multilevel) were weighted using the DHS-recommended weights.

Modelling approaches

A multilevel logistic regression model (MLRM)[30,31] was employed to investigate the relationship between individual, household and community factors and PTB in Kenya, utilising the BR data from the latest Kenya Demographic and Health Survey (KDHS). The 'melogit' command to construct the models. A two-level binary response model was specified to report PTBs. At the first level, women were analysed as individuals within households, while at the second level, households were nested within primary sampling units (PSUs), representing the household/community level.

Four models were developed in this study. The first was the empty or null model (Model 0), designed to estimate the variance in PTB attributable to clustering within PSUs. Empty models are critical for assessing random effects by estimating variance components at different hierarchical levels, helping determine whether multilevel modelling is appropriate. The second model (Model I) included only individual-level factors, while the third model (Model II) focused on household/community-level factors. The final model (Model III) was a comprehensive model that simultaneously accounted for individual and household/community-level variables. Multicollinearity tests were conducted for Model III, confirming no variable had a variance inflation factor above 10 or a tolerance below 0.05, indicating no significant multicollinearity.

The MLRM included both fixed and random effects. Fixed effects (measures of association) assessed the relationship between explanatory variables or confounders and PTB, reported as adjusted odds ratios (aOR) with 95% confidence intervals (CIs). Random effects (measures of variation) were examined using intra-cluster correlation (ICC) and related parameters to understand variations in PTB across PSUs. The likelihood ratio (LR) test assessed model adequacy, while Akaike's information criterion (AIC) and Bayesian information criterion (BIC) evaluated model fit. The LR test also compared nested models to determine if incorporating random effects enhanced model performance. The MLRM approach was utilised because it helps analyse the relationship between a dependent variable and multiple independent variables, enabling better prediction, decision-making and understanding of complex data patterns in various health domains.[31–33]

Sample weights were applied to address over- and under-sampling, and the 'svy' command was used to adjust for the survey's complex design, ensuring the findings' generalisability.[27,34,35] All statistical analyses and modelling were conducted using Stata version 17.0.[36] Finally, the reporting of this study conforms to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement[37]; see Table S1 for more information.

Results

The study found that the prevalence of PTB among women of reproductive age in Kenya was 7.14% (Figure 1). The frequency table (Table 1) shows that more than half of the women were aged 25–34 (52.8%), and those with primary and secondary education were 36.6% and 34.5%, respectively. The analysis also showed that 35% of the respondents reported their partners having primary education, and 32% reported their partners having secondary education. Most women were married (87.3%). 22% of the respondents were from the poorest households, and 21.9% were from the richest households. It was also found that 69.1% of the women had more than four ANC visits during pregnancy, even as most

Table 1. Descriptive characteristics of study respondents and distribution of preterm birth among women of reproductive age and other selected characteristics in Kenya.

Variables	Freq. (*n*)	Percent (%)	Preterm birth		*p* Value (χ^2)
			No	Yes	
Individual-level variables					
Age group					<0.001 (46.16)
15–24	2004	27.49	90.87	9.13	
25–34	3850	52.81	95.06	4.94	
35–49	1437	19.71	94.4	5.6	
Highest level of education					<0.001 (43.12)
No education	758	10.39	96.23	3.77	
Primary	2670	36.61	94.11	5.89	
Secondary	2520	34.56	91.39	8.61	
Higher	1344	18.43	93.65	6.35	
Partner's highest level of education					<0.001 (35.67)
No education	672	9.22	96.6	3.4	
Primary	2558	35.08	93.75	6.25	
Secondary	2352	32.25	92.06	7.94	
Higher	1710	23.45	93.18	6.82	
Current marital status					0.136 (2.22)
Married	6,366	87.31	93.89	6.11	
Living with a Partner	925	12.69	92.53	7.47	
Employment status					<0.05 (5.61)
No	3220	44.16	94.36	5.64	
Yes	4071	55.84	93.1	6.9	
Birth interval in months					0.186 (1.75)
25+ months	4664	82.9	95.21	4.79	
⩽24 months	962	17.1	94.35	5.65	
Antenatal care visits					<0.001 (0.58)
<4	2250	30.86	93.49	6.51	
4+	5041	69.14	93.91	6.09	
Multiple pregnancy					0.446 (1.09)
No	7128	97.75	93.72	6.28	
Yes	164	2.25	95.52	4.48	

(Continued)

Table 1. (Continued)

Variables	Freq. (*n*)	Percent (%)	Preterm birth		*p* Value (χ^2)
			No	Yes	
Sex of foetus					0.906 (0.01)
Male	3720	51.02	93.79	6.21	
Female	3571	48.98	93.73	6.27	
Type of place of delivery					<0.001 (19.12)
Health facility	6410	87.91	93.17	6.83	
Non-health facility	882	12.09	96.05	3.95	
History of pregnancy termination					<0.05(4.96)
No	6243	85.62	94.01	5.99	
Yes	1049	14.38	92.34	7.66	
Household and community-level variables					
Household wealth index					<0.001 (30.00)
Poorest	1606	22.02	95.72	4.28	
Poorer	1261	17.3	93.05	6.95	
Middle	1235	16.93	93.08	6.92	
Richer	1586	21.75	93.18	6.82	
Richest	1604	21.99	91.69	8.31	
Type of place of residence					<0.05 (11.27)
Urban	2733	37.48	92.52	7.48	
Rural	4559	62.52	94.4	5.60	
Sex of household head					0.704 (0.14)
Male	5828	79.93	93.71	6.29	
Female	1463	20.07	93.95	6.05	
Community literacy level					<0.001 (25.13)
Low	1475	20.23	95.51	4.49	
Medium	5817	79.77	92.75	7.25	
Community poverty level					0.308 (2.36)
Low	4,191	57.48	94.05	5.95	
Medium	22	0.31	92	8.00	
High	3,078	42.22	93.2	6.80	

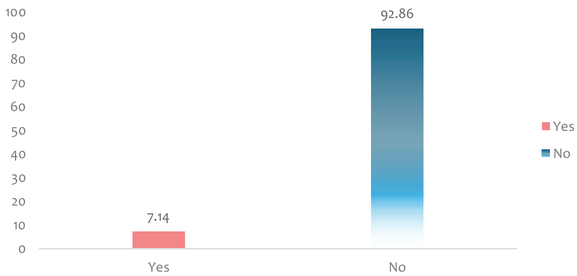

Figure 1. Prevalence of preterm birth among women of reproductive age in Kenya.

had a birth interval of 25+ months (82.9%). Considering household and community-level variables, 62.5% of the women reside in urban areas, and 79.9% live in male-headed households. In comparison, 20.2% reside in communities where the literacy level is low, and 57.5% reside in communities where the poverty level is low.

The bivariate analysis employing the chi-square test of independence shows that there is a statistically significant association between age, woman's highest level of education, partner's highest level of education, household wealth index, employment status, type of place of delivery, history of pregnancy termination, type of place of residence, community literacy level and preterm delivery at $p < 0.05$. The distribution shows that the highest percentage of PTB is among young women aged 15–24 years (9.1%); for the education of women, the greater proportion of those with PTBs are women with secondary education (8.6%), while the same pattern also shows for partners level of education (7.9%). The result also showed that a higher proportion of PTBs occurs among cohabiting women (7.5%), while 8.3% of women from the richest households experience PTBs. A higher proportion of PTBs was found among women with less than four ANC visits during pregnancy (6.5%). At the same time, it was also found that 7.6% of women with a history of pregnancy termination had PTB compared to 5.9% for women with no such history. Household and community-level variables indicate a higher proportion of PTB among women residing in urban areas (7.4%). The percentage of PTB is 6.3% among women from male-headed households compared to 6.1% for women from female-headed households. Finally, a higher rate of PTBs is among women from medium literacy communities (7.3%), and for community poverty level, a higher percentage is found among women from medium poverty level.

Fixed effects (measures of association)

With the individual-level factors, the likelihood of PTB was lower among older women aged 25–34 (aOR = 0.67; 95% CI: 0.49–0.94) and 35+ (aOR = 0.86; 95% CI: 0.59–1.24) compared to young women (15–24). Employed women (aOR = 1.40; 95% CI: 0.74–1.82) were found to be 40% more likely to have PTBs compared to unemployed women. It was also found that women who had four or more ANC visits during pregnancy were 38% less likely to have preterm deliveries than women who had less than four ANC visits during pregnancy (aOR = 0.68; 95% CI: 0.53–0.88). Also, women with a history of pregnancy termination are 46% more likely to have PTB than women who have never terminated a pregnancy (aOR = 1.46; 95% CI: 1.09–1.96). In terms of household and community-level variables, the analysis showed a relationship between household wealth index and PTBs; specifically, the likelihood of PTB is higher for women from middle-class households (aOR = 1.79; 95% CI: 1.19–2.69) and richest households (aOR = 2.28; 95% CI: 1.39–3.74) compared to women from the poorest households. A statistically significant relationship was also found between community literacy level and PTBs; women from communities with a low literacy level have a 36% lower likelihood of PTB than women from middle-level literacy communities (aOR = 1.56; 95% CI: 1.21–2.03).

Random effects (measures of variations)

As shown below in Table 2, the empty model depicted a substantial variation in the likelihood of PTBs in Kenya across the PSUs clustering ($\sigma^2 = 0.93$; 95% CI: 0.64–1.36). The empty model (Model 0) indicated that 22% of the variation in PTBs in Kenya was attributed to the variation between-cluster characteristics (i.e. ICC = 0.22). The cluster divergence decreased to 21% in Model I, representing only the individual-level model (Model I). In the community-level only model (Model II), the ICC increased to 20% from the previous ICC of 21% at the individual-level model. While in the complete model (Model III), with both the individual and household/community models, ICC rose to 21%. This further

Table 2. Multilevel logistic regression models of the individual and household/community-level factors associated with preterm births in Kenya.

Preterm birth	**Model 0**	**Model I**	**Model II**	**Model III**
Fixed effects results	**cOR (95% CI)**	**aOR (95% CI)**	**aOR (95% CI)**	**aOR (95% CI)**
Age				
15–24		RC		RC
25–34		0.67*** (0.49–0.94)		0.68*** (0.49–0.94)
35–49		0.86 (0.59–1.24)		0.86 (0.59–1.24)
Highest level of education				
No education		RC		RC
Primary		0.85 (0.54–1.36)		0.86 (0.53–0.134)
Secondary		1.03 (0.62–1.73)		1.04 (0.60–1.80)
Higher		0.79 (0.41–1.52)		0.80 (0.40–1.58)
Partner's highest level of education				
No education		RC		RC
Primary		1.34 (0.82–2.19)		1.34 (0.82–2.20)
Secondary		1.22 (0.71–2.09)		1.23 (0.71–2.11)
Higher		1.22 (0.71–2.09)		1.12 (0.59–2.11)
Marital status				
Married		RC		RC
Living with partner		1.07 (0.70–1.64)		1.09 (0.71–1.67)
Employment status				
No		RC		RC
Yes		1.40** (0.74–1.82)		1.40** (1.07–1.83)
Birth interval in months				
25+ months		RC		RC
⩽24 months		1.31 (0.98–1.75)		1.31 (0.98–1.76)
Antenatal care visits during pregnancy				
<4		RC		RC
4+		0.68** (0.53–0.88)		0.68*** (0.53–0.88)
Multiple pregnancy				
No		RC		RC
Yes		0.72 (0.30–1.71)		0.72 (0.30–1.70)

(Continued)

Table 2. (Continued)

Preterm birth	Model 0	Model I	Model II	Model III
Fixed effects results	**cOR (95% CI)**	**aOR (95% CI)**	**aOR (95% CI)**	**aOR (95% CI)**
Sex of the foetus				
Male		RC		RC
Female		1.13 (0.89–1.43)		1.13 (0.90–1.43)
Type of place of delivery				
Health facility		RC		RC
Non-health facility		0.94 (0.65–1.35)		0.93 (0.65–1.34)
History of pregnancy termination				
No		RC		RC
Yes		1.46** (1.09–1.96)		1.46 (1.09–1.96)
Household wealth				
Poorest				RC
Poorer		1.46 (0.98–2.18)		1.49 (0.99–2.23)
Middle		1.79** (1.19–2.69)		1.84*** (1.19–2.83)
Richer		1.35 (0.89–2.10)		1.45 (0.86–2.44)
Richest		2.28** (1.39–3.74)		2.53*** (1.34–4.77)
Sex of household head				
Male			RC	RC
Female			1.01 (0.80–1.28)	0.87 (0.64–1.18)
Residence				
Urban			RC	RC
Rural			0.81 (0.65–1.02)	1.13 (0.76–1.66)
Community literacy level				
Medium			RC	RC
Low			0.64*** (0.49–0.83)	1.07 (0.73–1.58)
Community poverty status				
High			RC	RC
Low			0.97 (0.76–1.22)	0.95 (0.69–1.31)
Medium			1.27 (0.17–9.45)	1.90 (0.24–15.20)

(Continued)

Table 2. (Continued)

Preterm birth	Model 0	Model I	Model II	Model III
Fixed effects results	**cOR (95% CI)**	**aOR (95% CI)**	**aOR (95% CI)**	**aOR (95% CI)**
Random effects results				
PSU variance (95% CI)	0.93 (0.64–1.36)	0.88 (0.52–1.48)	0.81 (0.54–1.22)	0.89 (0.53–1.49)
ICC	0.22	0.21	0.20	0.21
LR test	$\chi^2=50.49$; $p<0.001$	$\chi^2=22.91$; $p<0.001$	$\chi^2=39.05$; $p<0.001$	$\chi^2=23.09$; $p<0.001$
Wald χ^2	Reference	55.65***	20.09***	57.47***
Model fitness				
Log-likelihood	−1909.46	−1261.59	−1899.36	−1260.62
AIC	3822.91	2567.17	3812.72	2575.24
BIC	3836.96	2716.65	3861.87	2758.69
Number of clusters	1656	1656	1656	1656

Model 0 showed the uncontrolled or unadjusted result of preterm birth in Kenya.
Model I controlled for explanatory variables such as age, women's educational level, partner's educational level, marital status, employment status, birth interval, ANC visit, multiple pregnancies, type of place of delivery, history of pregnancy termination and household wealth index.
Model II controlled for explanatory variables such as the sex of the household head, community literacy level and community poverty status.
Model III controlled for all explanatory variables such as age, women's educational level, partner's educational level, marital status, employment status, birth interval, ANC visit, multiple pregnancy, type of place of delivery, history of pregnancy termination, household wealth index, sex of household head, community literacy level and community poverty status.
**$p<0.01$. ***$p<0.001$.
AIC, Akaike's Information Criterion; ANC, antenatal care; aOR, adjusted odds ratio; BIC, Bayesian Information Criterion; CI, confidence interval; cOR, crude odds ratio; ICC, intra-cluster correlation; LR, likelihood ratio; PSU, primary sampling unit; ref, reference.

reiterates that the variations in the likelihood of PTBs in Kenya are attributed to the clustering differences within PSUs and helped to quantify the extent to which contextual (multilevel) factors associated with each PSU contribute to the risk of PTBs in Kenya. For AIC and BIC, which are both statistical measures used for model comparison and selection, lower values of AIC and BIC indicate a better fit of the model to the data, with the best fitting model being the one with the lowest values of AIC and BIC. However, scholars have called for extra care when comparing models with similar or close AIC and BIC values. Other factors, such as theoretical/conceptual framework, research question and model interpretability, should be considered.[33] Hence, the complete model (Model III) with the selected individual and household/community factors, which have the second lowest AIC and BIC values, was chosen to achieve the study objective of assessing the multilevel factors that are associated with PTB in Kenya.

Discussion

This study investigated the prevalence and multilevel factors associated with PTB in Kenya using the most recent KDHS data. The prevalence of PTB in Kenya was 7.14% lower than the global PTB prevalence estimate of 9.9% reported in 2020 and published in 2023,[38] a previous hospital-based estimate of 12.3% reported in 2010.[3] It is also lower than those found in neighbouring countries in SSA, including Ethiopia (25.9%), Nigeria (16.9%), Tanzania (15.5%) and Uganda (19.4%).[39–42] The difference may be attributed to demographic differences between the studies' sample populations since they relied on hospital-based and institutional-level data. Furthermore, this study reported several individual and community-level factors associated with PTB outcomes in Kenya. Moreover, the findings corroborate the literature, indicating a downward trend in Kenya's maternal and neonatal health indices.

At the individual level, maternal age, employment status, less than four ANC uptake, and previous pregnancy termination were significant predictors of PTB. These findings align with earlier studies in Kenya, those conducted in SSA, and globally.[13,14,39,43,44] In this current study, women aged 24–34 years were less likely to experience PTB compared to those aged 15–24. This is not surprising, considering that women in this age group tend to have protective factors such as limited exposure to chronic conditions or obstetric complications that can lead to PTB.[45,46] On the contrary, younger women may be reproductively immature, increasing their risk of PTB.[6,47] Concerning employment status, we found that employed women had 40% increased odds of having PTB than unemployed women. This corroborates other studies' findings that employed women have a higher likelihood of PTB than their unemployed counterparts.[5] Evidence shows that the type of work determines neonatal outcomes; hence, women exposed to occupational hazards during pregnancy or other highly intense work environments may experience negative birth outcomes.[5,48,49] This study calls for workplace safety strategies to prevent dangerous workspaces that expose pregnant women to increased maternal health problems. Studies have found that family-friendly workplaces can reduce adverse health and psychological outcomes among pregnant employees.[50]

This study shows that women with four or more ANC visits were 38% less likely to have PTB than those with four or fewer ANC visits. Research has shown similar findings of a negative association between the number of ANC utilisation and the risk of PTB and other adverse outcomes.[44,51] ANC visits are important in recognising high-risk behaviours among pregnant women and promptly managing ensuing complications during pregnancy to prevent adverse birth outcomes such as PTB.[44,52] Moreover, the WHO recommends a minimum of eight ANC visits during pregnancy[53] for optimal maternal and neonatal health outcomes. We found that 7.6% of women with a history of pregnancy termination had PTB compared to 5.9% for women without such a history. This study did not specify the type of pregnancy termination; however, previous studies have shown that prior pregnancy termination, including uterine evacuation of pregnancy and induced abortion, increases the likelihood of PTB among women.[54,55] This phenomenon may be attributed to physiological trauma caused by a previously terminated pregnancy, which may impact the ability of the mother to carry a foetus to term. In addition, the risk factors that cause PTB and previously terminated pregnancies may be similar.[5,56]

In the current study, although PTB occurred more frequently among women with $\leqslant$24 months birth interval, this finding was statistically insignificant. Previous studies have, however, shown that short intervals between pregnancies significantly increase the risks of PTB among women.[57–59] This is plausible as women with short intervals between births are more likely to be exposed to demographic risk factors for poor birth outcomes and are more likely to have experienced negative birth outcomes in their preceding pregnancy.[60,61] While we may not fully explain our findings, there is a need for more research to observe further the association between short intervals of birth and PTB in Kenya.

At the community level, our analysis showed a relationship between the household wealth index and PTB. Consistent with a study conducted in India,[56] we found that the likelihood of PTB was higher for women from middle-class and richest households than women from the poorest households. We also found a statistically significant relationship between community literacy level and PTB, with women from communities with a medium literacy level showing a higher likelihood of PTB than women from low literacy-level communities. Abundant studies have indicated a strong link between wealth status and literacy levels and maternal health service utilisation and outcomes.[62–65] For example, women from richer households tend to have higher agency and wherewithal to seek and utilise unnecessary obstetrical procedures such as caesarean sections[66–68] was a significant risk factor for PTB. Another plausible reason for the observed relationship between wealth index and PTB could be the increased prevalence of lifestyle-related risk factors among women from wealthier households. Women in middle-class and richest households may have greater access to processed foods, sedentary lifestyles and higher stress levels due to work or social expectations, which are associated with an increased risk of adverse pregnancy outcomes, including PTB.[60] However, there is a need for further rigorous evaluation to further understand the pathways through which household and wealth indices impact PTB among Kenyan women.

Policy and public health implications

Several policy and public health implications can be drawn towards preventing PTB in Kenya. Based on our findings, multipronged efforts addressing behavioural, economic, and obstetric factors are necessary. In the behavioural domain, solutions must be developed to educate women across diverse age groups, particularly younger women. Since biological risk factors increase the risk of PTB for younger women, efforts to improve timely access to health services such as ANC must be encouraged to identify, monitor, and treat women at risk of adverse maternal outcomes. Similarly, preventive measures to protect women from reproductive hazards at the workplace by ensuring that they are not exposed to harmful substances or toxins should be considered. Again, protecting women from stressful workloads and demands that can increase the risk of cardiovascular diseases may be feasible. Our study also found that attending up to four ANC visits reduces the odds of PTB among Kenyan women. Therefore, we recommend measures to encourage timely and adequate ANC for all Kenyan women. Improving access to universal health coverage and continuous health education about the benefits of ANC may increase its uptake. Women with previous pregnancy termination had an increased probability of PTB. This suggests missed opportunities, particularly regarding the surveillance of women at a high risk of adverse perinatal outcomes. We recommend continuous follow-up of women throughout their reproductive health and quality data collection and management process. Also, we recommend policies to increase contraceptive access and abortion care to prevent unwanted pregnancies – a significant predictor for abortion. Finally, considering the significant association between PTB and community-level wealth status and literacy levels, our study has community-level implications. We recommend strategies to educate mothers about utilising only medically necessary procedures that may increase the risk of PTB. From the health system side, it is essential that providers only recommend these procedures when the health of the mothers and babies is at risk. For example, research has shown that even without any medical indication, some providers only prescribe a caesarean section birth for women with a history of birthing through caesarean section delivery. Moreover, reducing unnecessary medical procedures may reduce health system costs and other medical procedure-related complications.

Strengths and limitations

This study's strengths include using a large, nationally representative KDHS data set to assess the determinants of PTB in Kenya. As such, findings from this study are generalisable to the larger population of women of reproductive age in Kenya. However, some limitations must be acknowledged. While the large sample size reduces the margin of error, the data were collected within a specific time, making it impossible to assess causal relationships between the independent variables and outcome PTBs. This study is also limited because we did not measure other important variables, such as environmental pollution, quality of care, gestational diabetes, or hypertension in pregnancy, that are associated with PTB because the secondary dataset utilised does not measure these variables.

Furthermore, we do not know if the incidence of PTB was spontaneous or induced and the stage of PTB (i.e., late, moderate or early). Such crucial information is necessary to understand PTB's true pattern and risk factors in Kenya, allocate resources, and develop preventive measures for at-risk women adequately. In the same vein, PTB was self-reported without a clinical diagnosis to measure the gestational weeks accurately, and, given the data's cross-sectional nature, the data are prone to recollection bias. Another noteworthy limitation is that we found several unexpected results contrary to the literature, which may be due to data collection and other spurious relationships. Despite this limitation, this study provides timely and current insights about the prevalence and determinants of PTB in Kenya.

Conclusion

This study used the most recent KDHS data to investigate the prevalence and determinants of PTB in Kenya. We found a PTB prevalence of 7.14% and several individual levels (i.e., age, employment status, history of pregnancy termination, and four or fewer ANC visits) and community-level factors (i.e., wealth indices and literacy levels) to be predictors of PTB. Given the toll of PTB on patients, families, and society, this study advocates for improved public health efforts and strategies to protect maternal and neonatal health in Kenya. Our findings allow further rigorous evaluations and policy efforts to ensure optimal maternal and neonatal health in Kenya by prioritising ANC visits and addressing the identified community-level disparities. However, future studies should consider conducting qualitative and/or longitudinal studies to provide deeper insight into Kenyan women's experience of PTB.

Declarations

Ethics approval and consent to participate

This study utilised a secondary dataset from DHS. As the author did not collect the data used in this manuscript, permission to use the dataset was obtained from the MEASURE DHS website. Access was granted after a review and approval of the request was made on 15 August 2023. The dataset received was de-identified. All survey participants gave either verbal or written informed consent and were granted permission for their de-identified data to be used. For participants under the age of 18, informed consent, either verbally or in written forms, was sought from their parents or guardians prior to the interview. The DHS surveys adhere to ethical guidelines and comply with United States government health and service regulations, and all methods were performed according to the following relevant guidelines and regulations, such as the Declaration of Helsinki. The Kenya Medical Research Institute (KEMRI) Scientific and Ethics Review Unit (SERU) evaluated and approved all research protocols before the implementation of the Kenya Demographic and Health Survey (KDHS), ensuring compliance with ethical standards and local regulations. More information about DHS's ethical process can be found at https://dhsprogram.com/methodology/protecting-the-privacy-of-dhs-survey-respondents.cfm.

Consent for publication

Not applicable.

Author contributions

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Obasanjo Bolarinwa: Conceptualisation; Data curation; Formal analysis; Funding acquisition; Investigation; Methodology; Project administration; Software; Supervision; Validation; Visualisation; Writing – original draft; Writing – review & editing.

Toluwani E. Adekunle: Investigation; Writing – original draft; Writing – review & editing.

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Acknowledgements

The authors are grateful to MEASURE DHS for granting access to the dataset used in this study.

Funding

The authors received no financial support for the research, authorship and/or publication of this article.

Competing interests

The authors declare that there is no conflict of interest.

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author upon reasonable request. Additionally, the datasets used in this study were obtained from the demographic and health survey website, which can be obtained by requesting directly on the DHS website.

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Supplemental material

Supplemental material for this article is available online.

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