Contraception
and Reproductive Medicine

Modern contraceptive utilization among women of reproductive age in Ghana: a multilevel mixed-effect logistic regression model

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Abstract

Background Worldwide, sexual and reproductive health remains a prominent public health concern for women of reproductive age. Modern contraceptive methods play a crucial role in enabling individuals and families to regulate fertility, thereby reducing unintended pregnancies, abortions, pregnancy-related complications, and mortality. Due to the scarcity of reliable and current data regarding the factors affecting the adoption of modern contraceptives among women of reproductive age at the national level in Ghana, this research aimed to explore the determinants of modern contraceptive usage among reproductive age women.

Methods The study analyzed data from the 2022 Ghana Demographic and Health Survey, including a weighted sample of 6,839 reproductive-age women. By employing a multilevel logistic regression model, the study sought to determine factors associated with the utilization of modern contraceptives. Associations between explanatory variables and the outcome were evaluated using adjusted odds ratios (AORs) along with 95% confidence intervals (CIs). Statistical significance was established using a p-value threshold of less than 0.05. All statistical analyses were conducted using STATA version 17 software.

Results The study found that 26.36% (95% CI: 25.33-27.34%) of women of reproductive age in Ghana used modern contraceptives. Secondary education (AOR = 1.26, 95% CI = 1.03–1.53), poorer household (AOR = 1.30, 95% CI = 1.05–1.61), women's marital status, i.e. married (AOR = 1.46, 95% CI = 1.16–1.83), living with a partner (AOR = 1.65, 95% CI = 1.32–2.06), divorced (AOR = 2.53, 95% CI = 1.48–4.31), and separated (AOR = 1.70, 95% CI = 1.21–2.37), multipara (AOR = 1.39, 95% CI = 1.04–1.87), were the factors that promote modern contraceptive utilization. Women's age in years, i.e. 35–39 (AOR = 0.71, 95% CI = 0.52–0.97), 40–44 (AOR = 0.63, 95% CI = 0.44–0.90), and 45–49 (AOR = 0.45, 95% CI = 0.25–0.79), history of pregnancy loss (AOR = 0.86, 95% CI = 0.76–0.98), region, i.e. Greater Accra (95% CI = 0.42–0.92), Bono East (95% CI = 0.32–0.81), Northern (95% CI = 0.28–0.67), Savannah (95% CI = 0.28–0.81), and North East (95% CI = 0.20–0.63), were all associated with a lower use of modern contraceptives.

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Conclusions Modern contraceptive utilization was low in this study. Factors such as women's education, socioeconomic status, and marital status were associated with increased modern contraceptive utilization, whereas women's age and regional disparities were linked to lower usage rates. These findings emphasize the need for targeted interventions to address socioeconomic barriers and regional disparities in access to family planning services across Ghana.

Keywords Contraceptive utilization, Reproductive age, Multilevel analysis, Ghana

Background

Unintended pregnancies among sexually active women represent a significant public health issue [1]. A recent survey by the World Health Organization across 36 countries revealed that two-thirds of sexually active women who wish to delay or limit childbirth discontinue contraception due to health concerns, fear of side effects, and underestimation of pregnancy risks, resulting in one in four pregnancies being unwanted [2].

Modern contraceptive methods, including injectables, intrauterine devices (IUDs), pills, implants, emergency contraception, and sterilization options for both men and women, are effective in reducing unintended pregnancies [3]. Despite their importance, studies show that 85% of women experience pregnancy within one year of discontinuing contraception, often due to method-related issues such as side effects and logistical challenges [2].

In sub-Saharan Africa, low prevalence of modern contraceptive use contributes to high rates of unintended pregnancies, unsafe abortions, and maternal mortality [4, 5]. Strengthening family planning services is crucial; studies suggest that improved access could prevent up to 44% of maternal deaths [6]. Inadequate birth spacing, exacerbated by limited family planning options, significantly increases health risks for mothers and children [7].

Ghana has seen fluctuations in its total fertility rate (TFR), with recent figures indicating a decline to 3.9 children per woman in 2022. Despite a 60% total demand for family planning among married women, only 36% currently use contraceptives, highlighting a substantial unmet need [8].

Various factors influence the utilization of family planning services, as demonstrated by previous studies in different countries. Socioeconomic status, urban/rural location, and regional disparities have been identified as significant determinants in Ethiopia [9], while in Nigeria, age, parity, and partner's disapproval play crucial roles [10, 11]. Similarly, in Malawi, factors such as wealth quintile, educational level, and fertility intentions have been found to impact the uptake of modern contraceptive methods [12]. In Ghana specifically, factors affecting modern contraceptive utilization include lack of knowledge [13], history of childbirth [14], educational level [15], perception about contraceptive [13], history of abortion [14], and fear of side effects [16]. Our study in Ghana addresses a critical gap left by previous research [14, 15, 17], which often relied on outdated Ghana Demographic and Health Survey (GDHS) data. Despite scattered regional studies [16, 18–20], there is a significant absence of recent nationally summarized data on modern contraceptive usage and its determinants among reproductive-age women in Ghana. Therefore, our study aimed to fill this gap by assessing modern contraceptive utilization and its determinants using the latest nationally representative data, providing timely insights crucial for informed policy and interventions in reproductive health in Ghana.

Methods and materials

Study design

We used a cross-sectional study design based on data from the GDHS 2022.

Data source and study setting

The study utilized data from the 2022 GDHS, a nationally representative dataset on the DHS MEASURE Program website. The survey included a nationally stratified sample of 18,450 households organized into 618 clusters; with interviews conducted among 15,014 women aged 15–49 and 7,044 men aged 15–59. The 2022 GDHS employed a two-stage cluster sampling method. Initially, 618 clusters were selected using probability proportional to size (PPS) across urban and rural areas within each of the 16 regions. Subsequently, systematic random sampling was used to select a specified number of clusters in each region. Following cluster selection, household listings and map updates were conducted in all chosen clusters to compile comprehensive household lists. The Ghana Statistical Service updated the sample frame using 2021 Population and Housing data. Data collection instruments included household, woman, man, and biomarker questionnaires, focusing on various topics related to child and maternal health as outlined in the Woman's Questionnaire. Reproductive-age women from designated Enumeration Areas (EAs) constituted the study population, with data collection conducted between October 17, 2022, and January 14, 2023. Comprehensive sampling procedures are detailed in the complete GDHS 2022 report.

Study variables and measurements

Outcome variable

The dependent variable is the utilization of modern contraceptive methods during the survey, categorized as 'Yes' for individuals using any of the following methods: female sterilization, male sterilization, Pills, IUDs, injectables, implants, male condoms, female condoms, emergency contraception, standard days method (SDM), lactational amenorrhea (LAM), or other modern methods. Conversely, 'No' is assigned to those using rhythm, withdrawal, other traditional methods, or not using any family planning methods [6, 21–23].

Explanatory variables

Explanatory variables, both at the individual and community levels, were chosen based on their association with the reported outcome, as identified through a review of relevant literature. Selection criteria also considered the availability of these variables within the DHS datasets.

The investigation analyzed individual-level variables, encompassing age, educational attainment, religion, history of pregnancy loss, occupational status, parity, marital status, wealth index, and births in the last five years, alongside community-level variables, which included regions and residency.

Data management and analysis

Data handling and analysis were conducted using STATA version 17. Before performing the analysis, we confirmed the presence of the outcome variable in the GDHS dataset and checked all study variables for missing data. Records with missing observations were excluded from the analysis. Additionally, the dataset was weighted to adjust for sample non-representativeness among regions in Ghana, ensuring reliable estimates and standard errors. The study analyzed a weighted sample of 6,839 reproductive-age women.

The hierarchical nature of DHS data introduces intra-cluster correlation, necessitating advanced modeling techniques like multilevel modeling (MLM) to account for variability at different levels (clusters, households, individuals). Ignoring this correlation can lead to underestimated standard errors and inflated significance levels in traditional logistic regression models. MLM adjusts for between-cluster variability through random effects for clusters, improves model fit using criteria like Deviance Information Criterion (DIC) or Akaike Information Criterion (AIC), and ensures accurate estimation of coefficients and their standard errors. Cluster-robust standard errors are also crucial, as they correct for within-cluster correlation and prevent inflated variance of estimates, thereby providing more reliable statistical inference. This approach is essential for deriving accurate policy implications and ensuring robust decisions based on DHS findings. Hence, a multilevel logistic regression analysis was employed to examine how independent variables affect modern contraceptive use. Initially, variables showing a significance level (*p*-value) below 0.25 in the initial Bivariable multilevel logistic regression analysis were selected for inclusion in the subsequent multivariable regression model. In the multilevel logistic model, significant factors related to modern contraceptive use were declared using Adjusted Odds Ratios (AOR) with a 95% Confidence Interval (CI) and a *p*-value less than 0.05. Four models were executed in the multilevel logistic regression model to estimate the fixed effects of individual and community-level factors, as well as the random intercept of between-cluster variation. Given the nested nature of the models, assessment of model comparison and fitness relied on the Intra-class Correlation Coefficient (ICC), Likelihood Ratio (LR) test, Median Odds Ratio (MOR), and deviance (-2LLR) values [24]. Variance inflation factor (VIF) was used to check for multi-collinearity and there was no evidence of multicollinearity (VIF equal to 1.93). Accordingly, a mixed effects logistic regression model (fixed and random effects) was the best-fitted model since it had the lowest deviance value.

Results

Background characteristics of the study participants

This study analyzed 6,839 weighted reproductive-age women. The largest proportion fell within the 25–29 age group (24.67%), 48.65% had attained secondary education, and 29.98% were from households classified as the poorest. Most participants (95.16%) were multigravida, and 34.22% reported a history of pregnancy loss. Geographically, participants primarily resided in the Northern (9.53%), North East (8.66%), and Savannah (8.64%) regions, with the majority (57.36%) living in rural areas (Table 1).

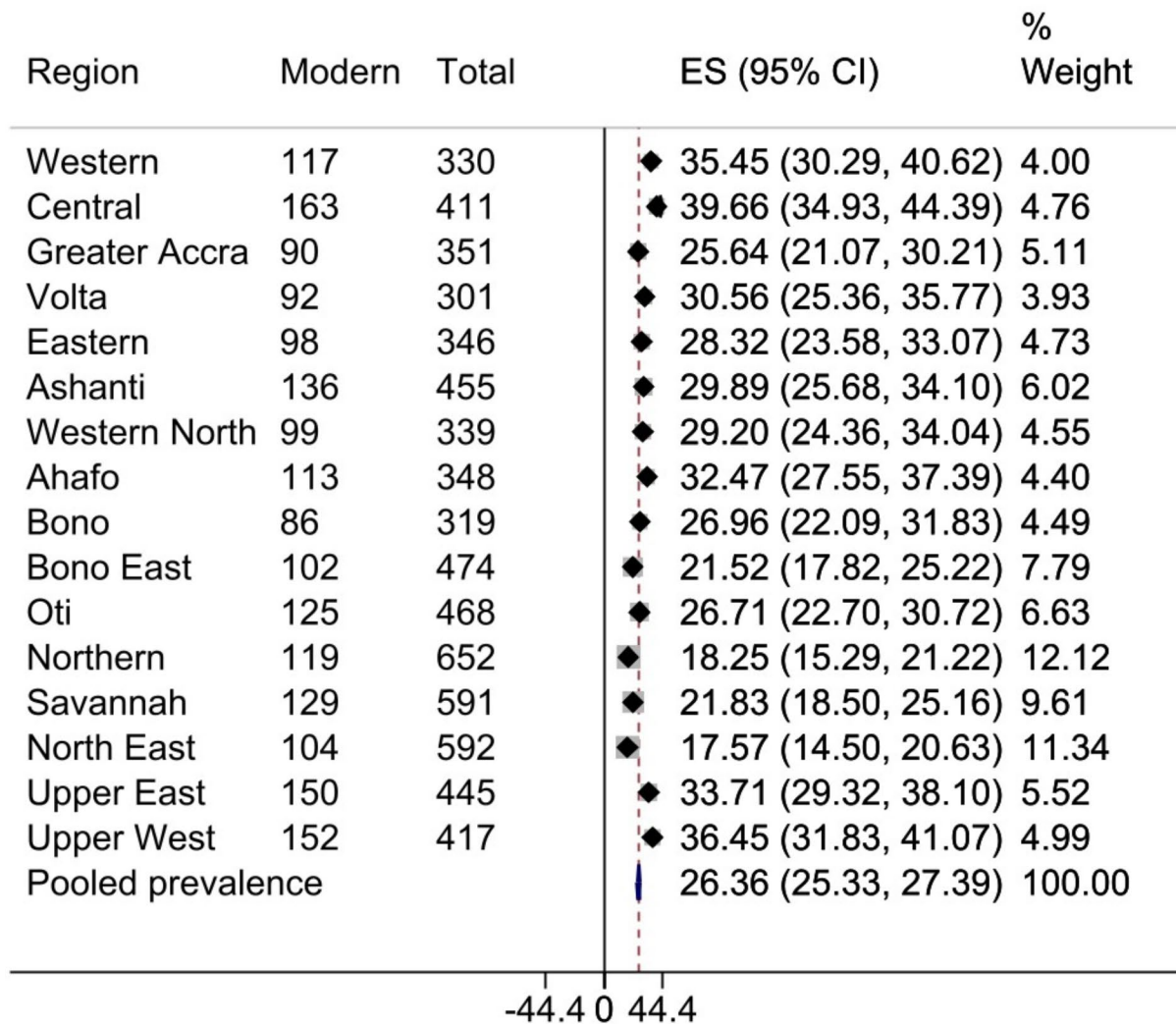### Prevalence of modern contraceptive utilization

The study found that 26.36% (95% CI: 25.33-27.34%) of women of reproductive age in Ghana used modern contraceptives. A regional analysis indicated that the North East region had the lowest prevalence at 17.57%, whereas the Central, Upper West, and Western regions showed relatively higher rates at 39.66%, 36.45%, and 35.45% respectively (Fig. 1).

The random effect analysis

The ICC within the null model revealed a 12.7% variance in modern contraceptive utilization among women of reproductive age across clusters. Analysis of the PCV within the final model indicated that 29% of the variance in modern contraceptive usage at the community level was explained by individual and community-level factors. Additionally, the MOR in the null model indicated

Table 1 Background characteristics of the study participants

Variables	Categories	Weighted Frequency	Percentage
Age	15–19	406	5.94
	20–24	1,451	21.22
	25–29	1,687	24.67
	30–34	1,530	22.37
	35–39	1,131	16.54
	40–44	500	7.31
	45–49	134	1.96
Highest educational level	No education	1,871	27.36
	Primary	1,096	16.03
	Secondary	3,327	48.65
	Higher	545	7.97
Religion	Catholic	652	9.53
	Anglican	37	0.54
	Methodist	203	2.97
	Presbyterian	249	3.64
	Pentecostal/Charismatic	2,368	34.62
	Other Christian	869	12.71
	Islam	2,106	30.79
	Traditional/Spiritualist	196	2.87
	No religion	159	2.33
History of pregnancy loss	No	4,499	65.78
	Yes	2,340	34.22
Wealth index	Poorest	2,050	29.98
	Poorer	1,630	23.83
	Middle	1,267	18.53
	Richer	1,060	15.50
	Richest	832	12.17
Place of residence	Urban	2,916	42.64
	Rural	3,923	57.36
Region	Western	330	4.83
	Central	411	6.01
	Greater Accra	351	5.13
	Volta	301	4.40
	Eastern	346	5.06
	Ashanti	455	6.65
	Western North	339	4.96
	Ahafo	348	5.09
	Bono	319	4.66
	Bono East	474	6.93
	Oti	468	6.84
	Northern	652	9.53
	Savannah	591	8.64
	North East	592	8.66
	Upper East	445	6.51
	Upper West	417	6.10
Parity	Primi-gravida	331	4.84
	Multi-gravida	6,508	95.16
Current marital status	Never in union	748	11.01
	Married	5,756	84.13
	Formerly married	335	4.91
Births in last five years	No births	532	7.78
	One	3,561	52.07
	Two	2,362	34.54
	Three or more	384	5.62

Region	Modern	Total	ES (95% CI)	% Weight
Western	117	330	35.45 (30.29, 40.62)	4.00
Central	163	411	39.66 (34.93, 44.39)	4.76
Greater Accra	90	351	25.64 (21.07, 30.21)	5.11
Volta	92	301	30.56 (25.36, 35.77)	3.93
Eastern	98	346	28.32 (23.58, 33.07)	4.73
Ashanti	136	455	29.89 (25.68, 34.10)	6.02
Western North	99	339	29.20 (24.36, 34.04)	4.55
Ahafo	113	348	32.47 (27.55, 37.39)	4.40
Bono	86	319	26.96 (22.09, 31.83)	4.49
Bono East	102	474	21.52 (17.82, 25.22)	7.79
Oti	125	468	26.71 (22.70, 30.72)	6.63
Northern	119	652	18.25 (15.29, 21.22)	12.12
Savannah	129	591	21.83 (18.50, 25.16)	9.61
North East	104	592	17.57 (14.50, 20.63)	11.34
Upper East	150	445	33.71 (29.32, 38.10)	5.52
Upper West	152	417	36.45 (31.83, 41.07)	4.99
Pooled prevalence			26.36 (25.33, 27.39)	100.00

-44.4 0 44.4

Fig. 1 National and regional prevalence of modern contraceptive utilization among women of reproductive age in Ghana, 2022

Table 2 The result of random-effect logit models in predicting modern contraceptive utilization among reproductive age women in Ghana

Parameter	Null model	Model I	Model II	Model III
Community-level variance	0.45	0.37	0.33	0.32
Log likelihood	− 3737.9	-3680.9	-3704.5	-3655.5
Deviance	7475.8	7361.8	7409	7311
MOR	1.74	1.58	0.55	0.54
PVC (%)	Reference	18	27	29
ICC (%)	12.7	10.1	9.3	9.1

heterogeneity in modern contraceptive prevalence across clusters, with a MOR value of 1.74. This implies that the likelihood of modern contraceptive utilization among reproductive age women in clusters with higher prevalence was 1.74 times greater compared to those in clusters with lower levels of modern contraceptive use. Model III exhibited the best fit based on deviance, demonstrating the lowest deviance among the tested models (Table 2).

The fixed effect analysis

As shown in Table 3, the multilevel multivariable logistic regression model revealed that women aged 35–39, 40–44, and 45–49 had significantly reduced odds of using modern contraceptive methods compared to those aged 15–19, with respective adjusted odds ratios (AORs) and 95% confidence intervals of 0.71 (0.52–0.97), 0.63 (0.44–0.90), and 0.45 (0.25–0.79).

Regarding educational attainment, women who had completed secondary education exhibited a 1.26-fold

Table 3 Multilevel multivariable logistic regression for determinants of modern contraceptive use among reproductive age women in Ghana

Categories	Null Model	Model I	Model II	Model III
Maternal age				
15–19	-	Ref	-	Ref
20–24	-	0.89[0.68–1.19]	-	0.88[0.66–1.15]
25–29	-	0.98[0.74–1.31]	-	0.98[0.73–1.29]
30–34	-	0.85[0.64–1.14]	-	0.87[0.65–1.16]
35–39	-	0.71[0.53–0.98]*	-	0.71[0.52–0.97]*
40–44	-	0.61[0.43–0.88]*	-	0.63[0.44–0.90]*
45–49	-	0.44[0.25–0.79]*	-	0.45[0.25–0.79]*
Maternal education				
No education	-	Ref	-	Ref
Primary	-	1.18[0.94–1.47]	-	1.18[0.94–1.47]
Secondary	-	1.25[1.03–1.53]*	-	1.26[1.03–1.53]*
Higher	-	0.94[0.69–1.27]	-	1.03[0.76–1.39]
Wealth index			-	
Poorest	-	1.13[0.87–1.47]	-	1.10[0.82–1.49]
Poorer	-	1.39[1.12–1.71]*	-	1.30[1.05–1.61]*
Middle	-	1.19[0.95–1.48]	-	1.14[0.89–1.46]
Richer	-	1.44[1.14–1.81]*	-	1.38[1.06–1.79]
Richest	-	Ref	-	Ref
Marital status				
Never in union	-	Ref	-	Ref
Married	-	1.58[1.26–1.97]*	-	1.46[1.16–1.83]*
Living with partner	-	1.69[1.36–2.10]*	-	1.65[1.32–2.06]*
Widowed	-	0.69[0.32–1.47]	-	0.66[0.30–1.42]
Divorced	-	2.67[1.56–4.56]*	-	2.53[1.48–4.31]*
Separated	-	1.74[1.25–2.44]*	-	1.70[1.21–2.37]*
History of pregnancy loss				
No	-	Ref	-	Ref
Yes	-	0.86[0.75–0.98]*	-	0.86[0.76–0.98]*
Parity				
Primi-gravida	-	Ref	-	Ref
Multi gravida	-	1.40[1.04–1.88]*	-	1.39[1.04–1.87]*
Residence		-		
Urban	-	-	Ref	Ref
Rural	-	-	1.09[0.92–1.28]	1.11[0.92–1.34]
Region	-			
Western	-	-	Ref	Ref
Central	-	-	1.19[0.82–1.75]	1.11[0.75–1.63]
Greater Accra	-		0.60[0.41–0.89]*	0.63[0.42–0.92]*
Volta	-	-	0.79[0.51–1.25]	0.78[0.49–1.22]
Eastern	-	-	0.71[0.47–1.06]	0.69[0.46–1.03]
Ashanti	-		0.70[0.49–1.02]	0.71[0.49–1.03]
Western North	-	-	0.69[0.42–1.14]	0.68[0.41–1.12]
Ahafo	-	-	0.88[0.52–1.47]	0.90[0.53–1.53]
Bono	-	-	0.64[0.40–1.04]	0.66[0.41–1.07]
Bono East	-	-	0.49[0.30–0.76]*	0.51[0.32–0.81]*
Oti	-	-	0.62[0.38–1.00]	0.61[0.38–1.01]
Northern	-	-	0.39[0.26–0.59]*	0.43[0.28–0.67]*
Savannah	-	-	0.43[0.26–0.72]*	0.48[0.28–0.81]*
North East	-	-	0.32[0.18–0.56]*	0.36[0.20–0.63]*
Upper East	-	-	0.85[0.55–1.33]	0.87[0.55–1.37]
Upper West	-	-	0.97[0.60–1.58]	1.00[0.61–1.64]

Key: Ref: reference group; *p-value < 0.05

increased likelihood of utilizing modern contraceptive methods compared to their counterparts without formal education (AOR=1.26, 95% CI=1.03–1.53). Women who was from the poorer household were 1.30 times more likely to utilize modern contraceptive method as compared to reproductive age woman from richest household (AOR=1.30, 95% CI=1.05–1.61).

Women who were married, living with a partner, divorced, or separated were 1.46 (AOR=1.46, 95% CI=1.16–1.83), 1.65 (AOR=1.65, 95% CI=1.32–2.06), 2.53 (AOR=2.53, 95% CI=1.48–4.31), and 1.70 (AOR=1.70, 95% CI=1.21–2.37) times more likely to utilize modern contraceptive methods compared to reproductive-age women who have never been in a union respectively. Women with a history of pregnancy loss had 14% decreased odds of contraceptive use compared to their counterparts (AOR=0.86, 95% CI=0.76–0.98). Multiparous women were 1.39 times more inclined to use modern contraceptive methods compared to primiparous women (AOR=1.39, 95% CI=1.04–1.87).

Our study also revealed women residing in the Greater Accra, Bono East, Northern, Savannah, and North East regions of Ghana were 37%, 49%, 57%, 52%, and 64% less likely to utilize modern contraceptive methods respectively compared to women residing in the Western region. Specifically, adjusted odds ratios (AORs) and their corresponding 95% confidence intervals (CIs) were 0.63 (95% CI=0.42–0.92), 0.51 (95% CI=0.32–0.81), 0.43 (95% CI=0.28–0.67), 0.48 (95% CI=0.28–0.81), and 0.36 (95% CI=0.20–0.63) for the mentioned regions, respectively.

Discussion

This study presents findings on modern contraceptive use among reproductive-age women, utilizing representative data from the 2022 GDHS. In this analysis, we included 6,839 women of reproductive age regarding modern contraceptive use and found a prevalence of 26.36% (95% CI: 25.33-27.34%). Our finding is in line with a study conducted in Senegal [22]. The present prevalence exceeds that documented in a prior study conducted in Sierra Leone [25]. However, the outcomes of this study were observed to be lower in comparison to investigations conducted in Burkina Faso [26], and Kenya [27]. The differing outcomes observed could potentially stem from differences in sample size, study design, setting, and characteristics of the study population.

According to the results of this study, a greater proportion of women aged 35–39, 40–44, and 45–49 were using traditional contraceptives compared to those aged 15–19. The current finding is consistent with previous research findings conducted in Senegal [22], Malawi [28], and Ethiopia [21]. Nevertheless, the present discovery contradicts previous studies [29–31], which reported higher use of modern contraceptives among older women compared

to younger women. The discrepant outcome might be attributed to older women in Ghana facing barriers in accessing healthcare services, including reproductive health services, due to factors such as distance to health facilities, financial constraints, and limited awareness about modern contraceptive methods [32].

In our study, it was observed that women who had completed secondary education were 1.26 times more inclined to utilize modern contraceptive methods than their counterparts lacking formal education. The findings of this study were supported by research conducted in multiple African contexts [33–36]. The underlying reasoning could be attributed to the premise that educated women are more likely to be informed about the benefits of modern contraception through exposure to diverse media channels such as newspapers, television, and various social media platforms. Additionally, it is conceivable that educated women tend to demonstrate proactive health-seeking behaviors and avail themselves of healthcare services, including family planning resources.

In this study, women from poorer households were 1.30 times more likely to utilize modern contraceptive methods compared to those from the wealthiest households. This finding stands in contrast to previous studies conducted in Ethiopia [21], Malawi [37], and Nigeria [38]. The observed disparity in outcomes may be attributed to the affordability or free provision of modern contraceptives through public health programs, making them more accessible to economically disadvantaged women compared to other family planning methods.

According to this study, women who were married, divorced, or separated were more likely to utilize modern contraceptive methods compared to reproductive-age women who have never been in a union respectively. This result aligns with findings from other studies conducted in Ethiopia [36, 39]. Firstly, marriage and cohabitation often correlate with increased sexual activity, leading to a greater perceived need for contraception. Women in these relationships are typically more sexually active and knowledgeable about their fertility and contraceptive options. Moreover, divorced or separated women, having experienced pregnancies or births, tend to be more aware and motivated to use contraception to prevent unintended pregnancies [40].

In our analysis, women who have experienced pregnancy loss exhibited a 14% reduction in the likelihood of using contraceptives compared to those without such a history. This discovery was consistent with findings from a study conducted in both Ethiopia [41] and Kenya [27]. This phenomenon may be attributed to the tendency for women who have experienced terminated pregnancies to utilize contraceptives less frequently, as they often harbor intentions of conceiving again.

Multiparous women were 1.39 times more inclined to use modern contraceptive methods compared to primiparous women. This finding aligned with research conducted in Ethiopia [42], Malawi [43], and Northwest Ethiopia [44]. Multiparous women's higher contraceptive use may be due to their experience with pregnancy, which boosts awareness of family planning and the need to prevent unintended pregnancies. They also typically have better access to reproductive health services compared to primiparous women navigating new family planning decisions.

Our study also revealed women residing in the Greater Accra, Bono East, Northern, Savannah, and North East regions of Ghana were less likely to utilize modern contraceptive methods compared to women residing in the Western region. This finding substantiated the results obtained from a study undertaken in Ghana [15]. This consistency underscores the persistent regional variations in contraceptive access and utilization observed over time in Ghana. The variation in modern contraceptive utilization across regions in Ghana reflects distinct socio-economic, cultural, and infrastructural characteristics that influence access and acceptance of family planning services. The lower prevalence of modern contraceptive use in the Greater Accra Region could be attributed to factors such as variations in healthcare accessibility despite higher urbanization and educational levels. Cultural factors and disparities in healthcare service distribution might also influence contraceptive utilization rates in this region. Conversely, regions like Bono East and Northern, characterized by rural settings and lower education levels, may face challenges related to healthcare access, awareness, and cultural norms favoring larger family sizes. The Savannah and North East regions, also predominantly rural, may experience similar barriers exacerbated by geographical remoteness and limited healthcare infrastructure. These disparities underscore the need for region-specific strategies, such as improving healthcare accessibility, addressing cultural beliefs through community engagement, and tailoring education campaigns to promote family planning, thereby ensuring equitable access to modern contraceptives across diverse regions of Ghana [45].

Strengths and limitations of the study
The study benefited from extensive national survey data, ensuring sufficient statistical power to detect the true impact of independent variables. Additionally, applying sampling weights during analysis ensured reliable estimates and standard errors. Moreover, the study examined modern contraceptive use at individual/household and community levels, enabling exploration of hierarchical or clustered influences on outcomes. However, a limitation arises from the study's reliance on cross-sectional data, precluding the establishment of causal relationships between knowledge of fertility periods and identified independent variables. Furthermore, because the DHS data relies on self-reported information, it is susceptible to recall bias.

Conclusions
Modern contraceptive utilization was low in this study. Factors such as secondary education, lower socioeconomic status, and certain marital statuses promote utilization, while older age groups and regional disparities are associated with lower usage rates. Initiatives should focus on increasing access and awareness among demographics with higher utilization rates, such as individuals with secondary education and lower socioeconomic backgrounds. Additionally, educational campaigns should target older age groups and regions with lower usage rates to promote comprehensive reproductive health education. Equitable distribution of family planning services across regions is essential to mitigate disparities. Future research should explore cultural and social factors influencing contraceptive decision-making to inform effective interventions.

Abbreviations
AOR	Adjusted Odds Ratio
CI	Confidence Interval
DHS	Demographic and Health Survey
GDHS	Ghana Demographic and Health Survey
ICC	Intra Class Correlation
IUDs	Intra uterine devices
LLR	Log-Likelihood Ratio
MOR	Median odds ratio
PVC	Proportional Change in Variance

Data availability
The original dataset utilized and analyzed in this research can be obtained from the DHS website at https://dhsprogram.com/data/dataset_admin/index.cfm.

Declarations

Ethics approval and consent to participate
The study involved a secondary analysis of survey data that was publicly released by the MEASURE DHS program. Informed consent was obtained from participants, and ethical approval for the research was obtained. The Ghana Health Service Ethics Review Committee has granted approval for the Ghana Demographic and Health Survey (GDHS). All methodologies adhered strictly to relevant guidelines and regulations. Data for this study were sourced from the DHS website (www.dhsprogram.com) subsequent to an online

authorization request, accompanied by justification for the investigation. Notably, the publicly accessible data used in this study did not contain personally identifiable information. For further information, readers are directed to https://dhsprogram.com/methodology/Protecting-the-Privacy-of-DHS-Survey-Respondents.cfm.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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