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Geographic variation in modern contraceptive utilization among women of reproductive age in Mozambique: a multilevel analysis

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Abstract

Background Modern contraceptives are crucial for reducing maternal and child mortality, yet Mozambique's contraceptive prevalence rate is very low, with significant regional disparities. This study investigates geographic variation in contraceptive use and the individual, community, and regional factors influencing it to guide equitable family planning interventions.

Methods This study utilized data from the 2022/23 Mozambique Demographic and Health Survey, analyzing a weighted sample of 9,316 women aged 15–49. The outcome variable was modern contraceptive use, with predictors including individual factors such as age, education, wealth, and marital status, as well as community-level factors like residence and region. Data analysis was conducted using Stata 17 and ArcGIS 10.7, employing multilevel logistic regression and spatial techniques (Global Moran's I, Getis-Ord Gi*, interpolation, and SaTScan) to identify patterns and geographic clusters of contraceptive use.

Results The study found a modern contraceptive prevalence of 34.8% (95% CI: 33.84–35.78). Key factors influencing usage included age, education, wealth, and healthcare access. Women aged 25–34 were 31% more likely to use contraceptives than those aged 15–24 (AOR: 1.31, 95% CI: 1.13–1.53). Secondary education more than doubled the likelihood (AOR: 2.25, 95% CI: 1.82–2.78), and wealthier women had a 74% higher likelihood (AOR: 1.74, 95% CI: 1.39–2.17). Fieldworker visits increased usage by 38% (AOR: 1.38, 95% CI: 1.15–1.64). Regional disparities were significant, with women in Cabo Delgado 81% (AOR: 0.19 95% CI: 0.14, 0.27) less likely to use contraceptives compared to Maputo. Higher usage was concentrated in Maputo and Southeastern Gaza. Spatial analysis revealed significant regional disparities, with hotspots in Maputo and Gaza, where women are 2.52 times more likely to use contraceptives, while rural areas like Cabo Delgado lag behind.

Conclusion Modern contraceptive use in Mozambique remains low, with regional disparities. Key factors influencing use include age, education, wealth, and healthcare access. Older, educated, and wealthier women are more likely to use contraception. Media exposure and proximity to healthcare facilities also play a role. Regional differences persist,

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with lower usage in provinces like Cabo Delgado and higher usage in urban areas like Maputo and Gaza. Targeted interventions are necessary to address these disparities.

Keywords Modern contraceptive, Reproductive-aged women, Mozambique

Introduction

The World Health Organization (WHO) defines modern contraceptive methods as hormonal pills, intrauterine devices (IUDs), implants, injections, condoms, and sterilization [1]. These methods are crucial for improving reproductive health and preventing unintended pregnancies. Their use empowers individuals, particularly women, to make informed reproductive choices [2]. By preventing high-risk pregnancies and ensuring appropriate birth spacing, modern contraceptives play a vital role in reducing maternal and child morbidity and mortality [3]. Furthermore, they contribute to the achievement of Sustainable Development Goals (SDGs) [4, 5], improving maternal and child health outcomes and promoting healthier families and communities [6].

Globally, an estimated 218 million women in low- and middle-income countries (LMICs) have an unmet need for modern contraceptives, contributing to high rates of unintended pregnancies, unsafe abortions, and maternal deaths [7]. In sub-Saharan Africa, only 29.6% of women of reproductive age use modern contraceptive methods [8], compared to the global average of 65% [9]. Mozambique reflects these challenges, with a contraceptive prevalence rate of just 26% among reproductive-age women, well below both regional and global averages [10]. Despite significant government efforts to expand access to family planning services, barriers persist. These include socio-economic inequities, cultural attitudes, and limitations in healthcare delivery [11].

Geographic disparities in contraceptive utilization are particularly evident in Mozambique, with urban areas generally exhibiting higher contraceptive prevalence rates than rural regions [10]. These disparities are influenced by unequal access to healthcare, variations in education and economic opportunities, and distinct cultural norms across regions [12, 13]. Such inequities not only reduce the effectiveness of family planning programs but also exacerbate health disparities, disproportionately affecting rural and marginalized populations [14].

Addressing these disparities requires a nuanced approach, as contraceptive use is shaped by both individual factors (such as education, income, and marital status) [15] and community-level characteristics (including healthcare infrastructure, cultural practices, and regional policies) [16]. While prior studies have explored determinants of contraceptive use [11–13, 16], the spatial patterns within Mozambique have received limited attention. Understanding these patterns is crucial for identifying geographic disparities in contraceptive access

and utilization, which often reflect unique challenges such as inadequate healthcare infrastructure or cultural barriers. Such knowledge enables the development of targeted, efficient, and location-specific interventions. This research examines how individual, community, and regional factors influence contraceptive use, particularly in light of the country's diverse geography and urbanrural divides. Identifying clusters of low utilization is especially important, as these areas often face heightened maternal and child mortality, exacerbating health inequities. Using a multilevel analytical framework, the study identifies geographic clusters and analyzes the sociocultural and structural determinants of contraceptive utilization. The findings will provide actionable insights for designing targeted interventions that aim to improve access to modern contraceptives in underserved areas, ultimately contributing to better reproductive health outcomes and a reduction in maternal and child mortality in Mozambique.

Method

Study area, data source, and design

Mozambique, located in southeastern Africa, borders Tanzania, Malawi, Zambia, Zimbabwe, South Africa, and Eswatini, with a coastline along the Indian Ocean. It spans 801,590 square kilometers and comprises 10 provinces, with Maputo as its capital. Portuguese is the official language, and the country's coordinates are 18°15′S, 35°00′E [17, 18].

This study utilized data from the 2022/23 Mozambique Demographic and Health Survey (MZDHS), which employed a multi-stage stratified sampling design to ensure national representation. The survey collected key health indicators, including maternal and child health and family planning data, from a weighted sample of women aged 15–49, representing both urban and rural populations [19].

Sampling and study population

The 2022/23 MZDHS applied a two-stage stratified sampling approach. In the first stage, 619 enumeration areas were selected (228 urban and 391 rural), with independent selection in each stratum. In the second stage, households were systematically chosen from a listing frame. This analysis focused on the women's dataset (IR file), which included a total weighted sample of 9,316 women aged 15–49. Women who met any of the following criteria were excluded: never had sex, were infecund or menopausal, or were currently pregnant.

Study variables

The outcome variable in this study was modern contraceptive use among women of reproductive age (15–49). This was a categorical variable with two categories: "Yes" for women who use modern contraceptive methods, and "No" for those who do not. Modern contraceptive methods considered included the pill, IUD, injections, female condoms, male condoms, implants (Norplant), female sterilization, male sterilization, lactational amenorrhea, emergency contraception, and the Standard Days Method.

The study used individual-level and community-level variables to analyze factors affecting modern contraceptive use. At the individual level, variables included age, education (both for the respondent and her husband), working status, number of living children, desire for more children, age at first sex, age at first birth, marital status, visits from health workers, visits to health facilities, source of contraceptives, and religion. Age was grouped into four categories: 15-24, 25-34, 35-44, and 45+. Education was classified into no education, primary, secondary, and higher, while the husband's education was similarly categorized. Employment status was defined as either "working" or "not working," and the number of living children was divided into categories: no children, 1–2, 3–4, and more than 4. Desire for more children was grouped into "want other," "undecided," and "want no more." Age at first sex and age at first birth were classified into categories under 18 years vs. 18+and under 19 years vs. 19+, respectively. Marital status was divided into never married, married/cohabiting, or widowed/ divorced/separated. Health worker visits and health facility visits were both categorized as yes/no, while the source of contraceptives was classified into four categories: government, NGO, private, or "don't know." Religion was divided into Catholic, Islamic, Zion, Evangelical/ Pentecostal, and Other.

At the community level, variables included residence (urban vs. rural), region (divided into 11 categories such as Niassa, Cabo Delgado, Nampula, etc.), and whether distance to the nearest health facility was considered a "big problem" or "not a big problem."

Data management and statistical analysis

For data analysis, Stata 17 and ArcGIS 10.7 were used. Sampling weights, primary sampling units, and strata were applied to ensure representativeness and adjust for the survey design. Weighted proportions for modern contraceptive use and other variables were calculated in Stata and visualized in ArcGIS for spatial analysis. The data were weighted to ensure accurate representation, and the prevalence of modern contraceptive use was reported with 95% confidence intervals (CIs). Given the hierarchical structure of the data, a multilevel logistic regression model was applied to account for variability between clusters [20]. Bi-variable analysis identified variables for inclusion in the multivariable model, with variables having p-values below 0.20 included in the final model. Before analysis, the outcome variable was confirmed, and missing data were excluded.

Four models were tested in the analysis: the Null Model (no predictors), Model II (individual-level variables), Model III (community-level variables), and Model IV (both individual and community-level variables). Adjusted Odds Ratios (AOR) with 95% CIs were used to report fixed effects, and statistical significance was set at p-values<0.05. Model fit was assessed using deviance and log-likelihood ratio tests. Random effects were quantified using the intra-class correlation coefficient (ICC) [21], proportionate change in variance (PCV) [22], and median odds ratio (MOR) [23]. The model with the lowest deviance, highest PCV, and lowest MOR was selected as the best fit. Multi-collinearity was evaluated with a Variance Inflation Factor (VIF) of 1.82, indicating no significant collinearity among independent variables [24].

The following equation fitted the multilevel logistic regression model.

$$Log\left(\frac{\pi ij}{1-\pi ij}\right) = \beta \ 0 + \beta \ 1xij + \beta \ 1xij \dots \ .\mu \ 0j + \epsilon \ 0ij$$

Where: πij : probability of modern contraceptive use; $1 - \pi ij$: probability of no modern contraceptive use; $\beta 0$: intercept; $\beta 1.\beta n$: regression coefficient of individual and community level factors; $\mu 0j$: random errors at cluster levels; $\epsilon 0ij$: random error at the individual level [25].

Spatial analysis

Spatial analysis was performed using ArcGIS 10.7 and Stata 17 to identify geographic variations in contraceptive use. Weighted proportions of contraceptive use were calculated in Stata 17 and visualized in ArcGIS. Global Moran's I statistic (0.921134, z-score=28.88) confirmed significant clustering of contraceptive use, suggesting a non-random geographic distribution. The Getis-Ord Gi statistic * identified areas with significantly high and low contraceptive use, indicating regions for targeted interventions. Kriging interpolation was applied to estimate contraceptive use in data-sparse regions, generating continuous surface maps. Finally, SaTScan (v10.2.4) identified spatial clusters of contraceptive use using a Bernoulli model, with statistical significance determined through log-likelihood ratios, relative risk, and Monte Carlo simulations, to pinpoint high-risk areas for interventions.

Results

In a weighted sample of 9,316 Mozambican women aged 15–49, the prevalence of modern contraceptive use was 34.80% (95% CI: 33.84, 35.78). Most were aged 15–24 (41.26%), married or cohabiting (69.64%), and classified as rich (47.45%). Education levels showed 42.16% had primary education, and 25.33% had none. A majority (67.05%) were unemployed, and 11.15% reported terminated pregnancies.

Only 10.57% were visited by fieldworkers, while 63.43% visited health facilities in the last 12 months. Median age at first sexual encounter was under 18 for 83.49%, and 59.52% had their first birth under 19. Contraceptives were sourced from private facilities by 51.16%. Birth data showed 43.74% had one child in the past five years, while 32.57% had none.

Household media exposure was reported by 52.98%, while 16.66% were childless, and 53.04% wanted more children. Most husbands had primary education (34.85%). Healthcare autonomy was reported by 70.17%, and religion was primarily Catholic (28.97%) or Evangelical/Pentecostal (29.34%) (Table 1).

Community data showed 40.46% lived in urban areas, 60.86% had no major healthcare access issues, and regional distribution was highest in Nampula (22.89%), followed by Zambezia (15.37%) (Table 2).

Multilevel logistic regression analysis Random effects and model fitness

A multilevel logistic regression analysis was performed to evaluate variability and model fit across clusters for modern contraceptive usage. The null model revealed a cluster variance of 1.24 (SE=0.11) and an intra-class correlation coefficient of 27.45% (95% CI: 24.21–30.93%), indicating substantial between-cluster variability. This cluster-level variance was statistically significant (P=0.001), and the Likelihood Ratio (LR) test confirmed that mixed-effects models fit the data better than a standard logistic model (LR test: X²(1)=1091.82, P<0.0001), underscoring notable differences in healthcare access barriers among clusters.

The Median Odds Ratio for modern contraceptive usage was 2.89 (95% CI: 2.65–3.17), signifying that women in clusters with higher contraceptive use had nearly three times the odds of using modern contraceptives compared to those in lower-use clusters.

Refined models progressively improved fit, culminating in the final model (Model III), which achieved a cluster variance of 0.20 (SE=0.05), an ICC of 5.75%, and an MOR of 1.53, indicating minimal between-cluster variability. The Proportional Change in Variance showed that 83.92% of the variability in modern contraceptive usage was explained by individual- and community-level factors. Model III also demonstrated superior fit based on deviance, AIC, and BIC values, effectively capturing the key determinants of modern contraceptive use while substantially reducing unexplained variability at the cluster level (Table 3).

Fixed effects results: multilevel logistic regression analysis

In Model III, modern contraceptive usage was significantly influenced by age, education, wealth, healthcare access, media exposure, age at first birth, desire for children, regional disparities, and access to health facilities.

Women aged 25–34 were 31% more likely to use modern contraceptives than those aged 15–24 (AOR: 1.31, 95% CI: 1.13–1.53), and those aged 35–44 were 45% more likely (AOR: 1.45, 95% CI: 1.19–1.76). Education strongly impacted usage: primary education increased likelihood by 48% (AOR: 1.48, 95% CI: 1.25–1.76), secondary education more than doubled the odds (AOR: 2.25, 95% CI: 1.82–2.78), and higher education showed similar trends (AOR: 2.14, 95% CI: 1.43–3.19).

Wealth status also mattered. Middle-income women were 24% more likely to use contraceptives compared to poor women (AOR: 1.24, 95% CI: 1.02–1.50), while rich women had a 74% higher likelihood (AOR: 1.74, 95% CI: 1.39–2.17). Access to healthcare was pivotal: visits by fieldworkers increased use by 38% (AOR: 1.38, 95% CI: 1.15–1.64), and health facility visits by 52% (AOR: 1.52, 95% CI: 1.30–1.78). Women who gave birth at age 19 or older were 72% more likely to use contraceptives (AOR: 1.72, 95% CI: 1.48–1.99), and those not wanting more children had a 68% higher likelihood of use (AOR: 1.68, 95% CI: 1.44–1.97).

Media exposure increased contraceptive use by 33% (AOR: 1.33, 95% CI: 1.15–1.55), while women who saw distance to health facilities as a barrier were 16% less likely to use contraceptives (AOR: 0.84, 95% CI: 0.73–0.97).

Regional disparities were stark, with women in Niassa (AOR: 0.43, 95% CI: 0.30–0.61), Cabo Delgado (AOR: 0.19, 95% CI: 0.14–0.27), and other provinces like Nampula, Zambezia, and Manica significantly less likely to use contraceptives compared to Maputo (Table 4).

Spatial autocorrelation of modern contraceptive usage in Mozambique

There was significant spatial variation in modern contraceptive usage across Mozambique, as evidenced by a Moran's I index of 0.921134 (p-value < 0.00001). This result indicates a clustering pattern, where regions with high contraceptive usage tend to be grouped together, and similarly, areas with low usage are clustered. The Z-score of 28.875862 reinforces the significance of this clustering, suggesting that the observed pattern is highly unlikely to have occurred by chance (Fig. 1).

 Table 1
 Socio-demographic characteristics of modern contraceptive usage among women of reproductive age in Mozambique,

 MZDHS 2022/23 (N=93,164)

Variables	Category	Weighted Frequency (n)	Percent (%)
Age in years	15–24	3,843.67	41.26
	25–34	3,460.09	32.70
	35–44	1,924.36	20.66
	>45	502.24	5.39
Marital status	Never married	1,497.35	16.07
	Married & living with a partner	6,488.09	69.64
	Widowed/Divorced/Separated	1,330.93	14.29
Wealth index	Poor	3,321.85	35.66
	Middle	1,574.26	16.90
	Rich	4,420.26	47.45
Educational status	No education	2,359.45	25.33
	Primary	3,928.04	42.16
	Secondary	2,740.88	29.42
	Higher	288	3.09
Working status	Not working	6,246.70	67.05
-	Working	3,069.67	32.95
Terminated pregnancy	No	8,277.25	88.85
	Yes	1,039.12	11.15
Visited by fieldworker in the last 12 months	No	8,331.84	89.43
<i>,</i>	Yes	984.52	10.57
Visited HF in the last 12 months	No	3,406.90	36.57
	Yes	5,909.47	63.43
Age at 1st sex	< 18	7,778.43	83.49
	≥18	1,537.93	16.51
Age at 1st birth	<19	5,545.57	59.52
	>=19	3,770.80	40.48
Source of contraceptive	Government	2,812.28	30.19
	Private	4,766.65	51.16
	Do not know	1,737.44	18.65
Births in last five	No birth	3,034.22	32.57
	One	4,074.76	43.74
	Two plus	2,207.38	23.69
Household Media exposure	No	4,381.02	47.02
	Yes	4,935.35	52.98
Number of living children	No children	1,551.66	16.66
	1–2 Children	3,486,14	37.42
	3–4 Children	2,567.98	27.56
	≥5 children	1,710.59	18.36
Desire for more children	Want other	4,940.96	53.04
	Undecided	1,941.25	20.84
	Want no more	2,434.15	26.13
Husband/partner's education level	No education	1,285.49	19.81
	Primary	2,261.05	34.85
	Secondry	1,735.16	26.74
	Higher	2376.06	3.66
	Don't know	968.79	14.93
Autonomy decision healthcare	No	1.935.47	29.83
	Yes	4,552.62	70.17
Religion	Catholic	2,699.38	28.97
	Islamic	1,861.48	19.98
	Zion	1,149.75	12.34
	Evangelical/Pentecostal	2,733.22	29.34
	Other	872.53	9.37

Variables	Category	Weighted Fre- quency (<i>n</i>)	Per- cent (%)
Residence	Urban	3,769.10	40.46
	Rural	5,547.27	59.54
Distance from	Big problem	3,646.28	39.14
health facility	Not big problem	5,670.01	60.86
Regions	Niassa	605.51	6.50
	Cabo delgado	470.40	5.05
	Nampula	2,132.68	22.89
	Zambezia	1,431.89	15.37
	Tete	882.59	9.47
	Manica	642.47	6.90
	Sofala	623.19	6.69
	Inhambe	423.60	4.55
	Gaza	532.02	5.71
	Maputo	1,046.80	11.24
	Cidade de Maputo	525.24	5.64

Table 2 Community-level characteristics of respondents inMozambique, MZDHS 2022/23

 Table 3
 Parameters and model fitness test result for multilevel logistic regression analysis

Null model	Model I	Model II	Model III
1.24 (0.11)	0.37 (0.06)	0.30 (0.04)	0.20 (0.05)
27.45	10.05	8.27	5.75
2.89	1.78	1.68	1.53
reference	70.54%	76.15%	83.92%
-5871.446	-3492.32	-5616.32	-3415.70
11,742.89	6,984.64	11,232.65	6,831.40
11746.89	7028.65	11260.65	6899.40
11761.21	7177.25	11360.88	7129.05
	Null model 1.24 (0.11) 27.45 2.89 reference -5871.446 11,742.89 11746.89 11761.21	Null model Model I 1.24 (0.11) 0.37 (0.06) 27.45 10.05 2.89 1.78 reference 70.54% -5871.446 -3492.32 11,742.89 6,984.64 11746.89 7028.65 11761.21 7177.25	Null model Model I Model II 1.24 (0.11) 0.37 (0.06) 0.30 (0.04) 27.45 10.05 8.27 2.89 1.78 1.68 reference 70.54% 76.15% -5871.446 -3492.32 -5616.32 11,742.89 6,984.64 11,232.65 11746.89 7028.65 11260.65 11761.21 7177.25 11360.88

SE = Standard Error: ICC = Intra-class Correlation Coefficient: MOR: Median Odds Ratio: PCV: Proportional Change in Variance: AIC = Akaike Information Criterion: BIC = Bayesian Information Criterion

Hotspot analysis of modern contraceptive utilization in Mozambique

The map highlights significant hotspots and cold spots in modern contraceptive use across Mozambique, based on the Getis-Ord Gi* statistic. Red areas indicate hotspots, representing regions with a high concentration of nonusers, including much of Zambezia, Nampula, Manica, central and northern Sofala, southern Cabo Delgado, and the north and northeastern parts of Tete. In contrast, green areas represent cold spots, showing regions with higher contraceptive usage, such as Maputo, Maputo City, southeastern Gaza, and eastern and southern Inhambane. This spatial analysis emphasizes key areas that require focused healthcare interventions (Fig. 2).

Interpolation of modern contraceptive utilization in Mozambique

The map employs ordinary Kriging interpolation to visualize modern contraceptive utilization rates in

Mozambique for 2022/23, with a five-color gradient: red indicating the highest predicted utilization in urbanized areas such as Southeastern Sofala, Northern Gaza, and Central Maputo City; orange for high utilization in regions like Southern Zambezia, Manica, and Tete; yellow for moderate utilization in Central/Eastern Zambezia, Central Nampula, and Northwestern Inhambane; light green for low utilization in Northern Zambezia, Western Niassa, and parts of Cabo Delgado; and dark green representing the lowest predicted utilization in rural, isolated areas like Northern Niassa, Central Cabo Delgado, and Northwestern Tete (Fig. 3).

Spatial SaTScan statistics analysis of modern contraceptive utilization in Mozambique

The spatial scan statistics identified a total of 483 significant clusters, with 224 of them classified as primary clusters, representing the most probable areas of interest. These primary clusters were located in Gaza, Maputo, Maputo city, the southern region of Manica, and Sofala, centered at coordinates (23.857715 S, 35.482275 E), covering a radius of 461.34 km. The analysis revealed a Relative Risk (RR) of 2.52 and a Log-Likelihood Ratio (LRR) of 5531.87, with a p-value of less than 0.0001. This suggests that women of reproductive age within the identified spatial window are 2.52 times more likely to use modern contraceptive methods compared to those outside this area (Table 5). The primary cluster is represented by a red circular window, while secondary clusters are indicated by purple rings. The overlap between these clusters points to regions where higher levels of modern contraceptive use are concentrated, suggesting areas that may benefit from focused interventions to enhance access to and awareness of contraceptive options (Fig. 4).

Discussions

Modern contraceptive use is essential for improving maternal and child health, controlling population growth, and promoting gender equality [26]. This study examines modern contraceptive use among Mozambican women aged 15–49 using data from the 2022/2023 DHS. The prevalence rate is 34.8% (95% CI: 34.5–35.1), reflecting significant progress from 9.1% in 2011 [25] and 26% in 2015 [10]. However, disparities remain, particularly in rural northern regions like Zambezia and Cabo Delgado, and among groups differing in age, education, wealth, and healthcare access. High-use areas are concentrated in urban centers such as Maputo City, underscoring the need for targeted, equitable, region-specific healthcare interventions.

In comparison to other African countries, Mozambique's rate aligns closely with Zambia's (34.1%) [27] but exceeds Liberia (25.3%) [27], Ethiopia (28.1%) [28], Ghana (26.36%) [29], Rwanda (29%) [30], and East African **Table 4**Multilevel logistic regression on the modern contraceptive usage among women of reproductive age in Mozambique,MZDHS 2022/23

Variables	Model I AOR (95%CI)	Model II AOR (95%CI)	Model III AOR (95%CI)		
Age of the respondent					
15–24	1.00	-	1.00		
25–34	1.31 (1.13, 1.53)**	-	1.31 (1.13, 1.53)**		
35–44	1.45 (1.19, 1.76)**	-	1.45 (1.19, 1.76)**		
>45	1.21 (0.89, 1.66)		1.21 (0.88. 1.65)		
Women education					
No education	1.00	-	1.00		
Primary	1.54 (1.30, 1.83)**		1.48 (1.25, 1.76)**		
Secondary	2.51 (2.03, 3.10)**	-	2.25 (1.82, 2.78)**		
Higher	2.59 (1.73, 3.87)**	-	2.14 (1.43, 3.19)**		
Wealth index					
Poor	1.00	-	1.00		
Middle	1.48 (1.22, 1.80)**	-	1.24 (1.02, 1.50)*		
Rich	2.60 (2.13, 3.17)**	-	1.74 (1.39, 2.17)**		
Working status					
Not working	1.00	-	1.00		
Working	1.36 (1.19, 1.55)**	-	1.194 (1.04, 1.36)*		
Terminated pregnancy					
No	1.00	-	1 00		
Yes	0.86 (0.72, 1.02)	_	0.86 (0.72, 1.03)		
Visit by fieldworker in the last 1	2 months		0.00 (02, 1.00)		
No	1.00	_	1.00		
Yes	1 27 (1 07 1 51)*	_	1 38 (1 15 1 64)**		
Health facility visits in the last 1	2 months		1.50 (1.15, 1.01)		
No	1.00	_	1.00		
Yes	1.61 (1.38, 1.88)**	-	1.50 (1.30, 1.78)**		
Age at first sex	1.01 (1.30, 1.00)		1.32 (1.30, 1.70)		
	1.00	-	1.00		
> 18	1.04 (0.87, 1.25)	_	0.96 (0.80, 1.15)		
Age at 1st birth	1.01(0.07, 1.23)		0.50 (0.00, 1.15)		
	1.00	_	1.00		
<u>-10</u>	0.61 (0.53, 0.71)**	_	1.00		
Desire for more children	0.01 (0.55, 0.71)		1.72 (1.40, 1.99)		
Want other	1.00	_	1.00		
	0.84 (0.69, 1.03)	_	0.87 (0.71, 1.07)		
Want no more	2 17 (1 75 2 67) **	_	1.68 (1.44, 1.97)**		
Birth in the last five years	2.17 (1.75, 2.07)		1.00 (1.44, 1.97)		
Nono	1.00		1.00		
	1.21 (1.11, 1.54)*				
	1.51(1.11, 1.54) 0.87(0.72, 1.06)	-	1.30 (1.17, 1.03)""		
Household modia exposure	0.87 (0.72, 1.00)		0.99 (0.82, 1.21)		
No	1.00		1.00		
No		-			
res	1.32 (1.14, 1.53)***	-	1.33 (1.15, 1.55)***		
No	1.00		1.00		
No	1.00	-	1.00		
	1.50 (1.12, 1.51)	-	1.19 (1.02, 1.58)		
Kesidence		1.00	1.00		
UIDAN Durus			1.UU		
		0.49(0.42, 0.57)**	0.87 (0.72, 1.05)		
Distance to nealth facility		1.00	1.00		
NUL DIG Problem		1.UU	1.UU		
ыg propiem		0.79 (0.70,0.88)**	0.84 (0.73, 0.97)*		

 Table 4 (continued)

Variables	Model I AOR (95%CI)	Model II AOR (95%CI)	Model III AOR (95%CI)	
Regions				
Maputo	Maputo		1.00	
Niassa		0.22 (0.16,0.30)**	0.43 (0.30, 0.61)**	
Cabo delgado	o delgado 0.15.(0.11, 0.20)** 0.19		0.19 (0.14, 0.27)**	
Nampula 0.11(0.08, 0.15)**		0.11(0.08, 0.15)**	0.22 (0.16, 0.32)**	
Zambezia	nbezia 0.12 (0.09, 0.17)** 0.22		0.22 (0.14, 0.32)**	
Tete		0.36 (0.27, 0.49)**	0.59 (0.42, 0.82)*	
Manica	anica		0.33 (0.24, 0.46)**	
Sofala		0.33 (0.25, 0.44)**	0.42 (0.30, 0.59)**	
Inhambe 0.67 (0.50, 0.90)		0.53 (0.38, 0.75)**		
Gaza	0.81 (0.61, 1.08)* 0.63 (0.46, 0.87)		0.63 (0.46, 0.87)*	
Cidade de Maputo		0.64 (0.47, 0.85)*	0.70 (0.49, 0.98)*	

AOR=Adjusted Odds Ratio, * = P value < 0.05, ** = P value < 0.001



Fig. 1 Spatial autocorrelation report. Given the z-score of 28.8758624432, there is a less than 1% likelihood that this clustered pattern could be the result of random chance

countries (20.68%) [25]. The differences may result from variations in sample size, study design, setting, and population characteristics. Nonetheless, it lags behind Kenya (39%) [31] and Malawi (54.8%) [32], indicating room for further improvement. These findings highlight the need for targeted interventions to address barriers. Adopting successful strategies from higher-performing countries could enhance equitable access and improve reproductive health outcomes for Mozambican women.

The regression analysis identified several key factors influencing modern contraceptive use in Mozambique. Individual-level predictors such as age, education, wealth, employment, age at first birth, desire for more children, media exposure, and recent childbirth significantly impacted contraceptive adoption. Additionally, women with greater autonomy in healthcare decisions and those with more access to health services through fieldworker visits or healthcare facilities were more likely



Fig. 2 Hot Spot Analysis of modern contraceptive utilization, Mozambique 2022/23. Source shape file: https://data.humdata.org/dataset/5e8d83a5-12 10-49bel-b7d9-cf286dbc15df

to use contraceptives. At the community level, regional disparities and geographic access to healthcare played a major role, with women in provinces like Niassa and Cabo Delgado facing barriers due to distance and limited infrastructure.

Age is significantly associated with contraceptive use, with women aged 25–34 being 31% more likely to use modern contraceptives, and women aged 35–44 being 45% more likely, compared to those aged 15–24. This pattern is consistent with studies from Ethiopia [33] and Bangladesh [34], which show that older women are more likely to use contraception, as they may have completed or nearly completed their family size [35]. However, studies in countries such as Cameroon [36], Kenya [2], East Africa [25], and Sub-Saharan Africa [37] show that younger women, particularly those still in school, tend

to use contraception more to delay family planning and focus on education.

Education is a key determinant of contraceptive use. Women with at least primary education are 48% more likely to use contraceptives compared to those with no education. This is consistent with studies from Ethiopia [38], Cameroon [39], Zimbabwe [40], East Africa [25], and other parts of Sub-Saharan Africa [27], where education is shown to correlate positively with increased contraceptive use. Higher education increases awareness and accessibility, empowering women to make informed decisions about their reproductive health.

Wealth status plays a significant role in contraceptive use, with women from wealthier households being more likely to use modern contraceptives. Wealthier women often have better access to healthcare services and family planning resources, which makes contraception more



Fig. 3 Interpolation of modern contraceptive utilization, Mozambique 2022/23 N. Source shape file: https://data.humdata.org/dataset/5e8d83a5-121 0-49bel-b7d9-cf286dbc15df

accessible. Studies from Zimbabwe [40], Senegal [41], Cameroon [39], and East Africa [25] have shown similar trends, indicating that wealthier women can afford transportation and healthcare costs, which in turn improves their ability to access contraceptive services.

Employment status also influences contraceptive use. Working women are more likely to use modern contraceptives, as employment provides them with greater financial autonomy and access to healthcare. This link between employment and contraceptive use has been observed in studies from Bangladesh [42], Ethiopia [43], and Ghana [44], which highlight the positive impact of women's labor participation on their ability to use contraceptive methods.

Healthcare engagement significantly enhances contraceptive use. Women visited by fieldworkers are 38% more likely to adopt contraception, and those who visit health facilities are 52% more likely to do so. This highlights the importance of community outreach and accessible healthcare services in promoting family planning. Mozambique's focus on improving its healthcare infrastructure aligns with these findings, emphasizing the role of healthcare access in increasing contraceptive use [45].

Women who have children at 19 or older are 72% more likely to use contraception. This is likely due to factors such as greater education, employment, socioeconomic stability, and access to family planning resources. Older women tend to have more control over their reproductive decisions, making them more likely to adopt contraceptive methods [46–48].

Women who wish to have no more children are 1.68 times more likely to use modern contraceptives. This

2022/25						
Cluster	Coordinates/ radius	Population	Cases	RR	LLR	P-values
1	(23.857715 S, 35.482275 E) / 461.34 km	28,810	17,174	2.52	5531.87	< 0.0001
2	(24.623481 S, 34.768105 E) / 412.09 km	25,492	15,649	2.48	5304.64	< 0.0001
3	(19.609525 S, 34.759148 E) / 27.91 km	2,473	1,579	1.88	443.50	< 0.0001
4	(16.111419 S, 33.600246 E) / 92.06 km	2,919	1,469	1.47	152.48	< 0.0001
5	(14.439111 S, 34.224685 E) / 19.42 km	290	219	2.18	100.43	< 0.0001
6	(18.986792 S, 33.258300 E) / 43.00 km	2,742	1,256	1.33	72.56	< 0.0001
7	(13.312592 S, 35.246259 E) / 1.63 km	468	273	1.68	53.97	< 0.0001
8	(14.329845 S, 36.795191 E) / 0 km	89	76	2.46	48.81	< 0.0001
9	(15.131318 S, 39.176448 E) / 7.84 km	700	358	1.47	39.43	< 0.0001
10	(16.838908 S, 36.983734 E) / 0 km	448	238	1.53	31.53	< 0.0001
11	(15.198814 S, 35.863956 E) / 0 km	189	119	1.81	31.03	< 0.0001
12	(17.864946 S, 36.924892 E) / 0 km	184	113	1.77	26.99	< 0.0001
13	(15.814126 S, 40.186606 E) / 0 km	154	98	1.83	26.49	< 0.0001
14	(14.800021 S, 36.526175 E) / 0 km	95	59	1.79	14.65	< 0.001
15	(17.316490 S, 35.592038 E) / 0 km	172	94	1.57	14.13	< 0.001
16	(15.716290 S, 39.343450 E) / 0 km	276	138	1.44	13.41	< 0.001
17	(17.869641 S, 36.887407 E) / 0 km	120	69	1.65	12.84	< 0.05

 Table 5
 Significant spatial clusters of modern contraceptive usage among women of reproductive age in Mozambique, MZDHS

 2022/23
 2022/23

desire to limit family size is often driven by considerations of economic stability, health, and the evolving social and cultural norms that support reproductive autonomy. Studies from Senegal [41], Ethiopia [49], and Indonesia [50] have highlighted these factors as key drivers of contraceptive use among women seeking to control their fertility.

Media exposure is another important factor associated with contraceptive use. Women with media exposure are 33% more likely to use contraception, emphasizing the role of mass media in promoting family planning. Studies from Zimbabwe [40], Senegal [41, 51], and Rwanda [52] have found similar results, showing that media helps raise awareness and reduces barriers to accessing contraceptive services.

Recent childbirth also increases the likelihood of contraceptive use. Women who have had a birth in the last five years are 1.38 times more likely to use modern contraceptives, as recent childbirth often raises awareness of the need to space pregnancies. The World Health Organization recommends a two-year gap between pregnancies to reduce maternal and infant health risks, which may further drive the adoption of contraception [53]. However, a study in Ethiopia [38, 49] did not support this trend, possibly due to cultural factors, limited access to contraceptive services, or gaps in family planning education.

Autonomy in healthcare decision-making is another important predictor of contraceptive use. Women with greater decision-making power in their healthcare are 19% more likely to use contraceptives. This is consistent with research in Senegal [41] and other Sub-Saharan African countries [54], where greater autonomy in reproductive health decisions leads to higher contraceptive use and reduced maternal and newborn mortality.

Geographic barriers also affect contraceptive use. Women who perceive distance to health facilities as a major challenge are 16% less likely to use contraceptives. This finding aligns with studies showing geographic barriers reduce contraceptive use [38, 39]. This highlights the importance of improving access to healthcare services, as increased engagement with healthcare facilities or fieldworkers can enhance contraceptive use. Mozambique's efforts to improve health infrastructure are crucial for addressing these geographic disparities.

Regional disparities in contraceptive use were also observed in this study. Women in provinces like Niassa, Cabo Delgado, Zambezia, Tete, Manica, Sofala, Gaza, and Cidade de Maputo were less likely to use contraceptives compared to those in Maputo city. The odds were particularly low in Cabo Delgado, Zambezia, and Nampula, likely due to limited healthcare infrastructure and cultural norms. Spatial analysis identified hotspots of non-use in regions like Zambezia, Nampula, Manica, and Cabo Delgado, while higher usage was observed in urban areas such as Maputo, southeastern Gaza, and Inhambane. These regional differences underscore the need for targeted interventions in less urbanized areas, where limited healthcare infrastructure and lower awareness contribute to contraceptive disparities.

Strengths and limitations of the study

This study provides valuable insights into modern contraceptive use among Mozambican women, drawing on nationally representative 2022/2023 DHS data. The study's strengths include its large sample size, its analysis



Fig. 4 SatTScan Analysis of modern contraceptive utilization, Mozambique 2022/23. Source shape file: https://data.humdata.org/dataset/5e8d83a5-12 10-49be-b7d9-cf286dbc15df

of both individual and community-level factors, and the use of spatial mapping to identify regional disparities. However, the study's cross-sectional design limits its ability to draw causal conclusions, and secondary data excluded factors such as service quality and cultural influences. Additionally, location data were shifted by 2 km in urban areas and 5-10 km in rural areas for confidentiality, and recall and social desirability biases may affect the accuracy of self-reported data. Future longitudinal studies with primary data are needed for a more comprehensive understanding of contraceptive use in Mozambique.

Conclusions

Modern contraceptive use in Mozambique stands at 34.8%, with notable disparities based on age, education, wealth, and geographic region. Key factors influencing contraceptive use include education, economic status, employment, media exposure, and access to healthcare. Older, more educated, and wealthier women are more likely to use contraception, while community-level factors, such as distance to healthcare facilities, also play a significant role. Regional differences persist, with lower usage in provinces such as Cabo Delgado, Zambezia, and Nampula, primarily due to limited healthcare infrastructure and geographic barriers. Urban areas like Maputo and parts of Gaza and Inhambane show higher usage. To address these disparities, the government should focus on improving healthcare infrastructure, promoting

education, supporting economic empowerment, and increasing media-driven awareness. These efforts, alongside comprehensive counseling services, can help ensure equitable access to modern contraceptives for all Mozambican women, particularly in rural and underserved provinces.

Abbreviations

DHS	Demographic and Health Survey
GIS	Geographic Information System
IUD	Intrauterine Device
MZDHS	Mozambique Demographic and Health Survey
SaTScan	Spatial Scan Statistics
WHO	World Health Organization

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Author contributions

HKN was involved in designing the study, data extraction, data analysis, interpretation, and manuscript writing; YTA and FSH contributed to data analysis, interpretation, and manuscript writing; DTG and HTE participated in data extraction and manuscript writing; NDB focused on analysis and result interpretation; MG engaged in data analysis, interpretation, and manuscript writing; TA was involved in analysis and result interpretation; and WT and TZ contributed to study design, interpretation, report, and manuscript writing. The final manuscript was read and approved by all authors.

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Data availability

No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participants

Permission to access the data was obtained from the Measure DHS Program via an online request at DHS Program. The publicly available dataset contains no personal identifiers, so no additional ethics approval was required. We registered on the DHS website, requested the dataset, and received authorization to download the data files, complying with all relevant guidelines and regulations.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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