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RESEARCH ARTICLE

Covert contraceptive use among women with a previous unintended pregnancy in Nigeria: A multilevel investigation of individual- and contextual-level factors

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Abstract

Covert contraceptive use is a strategy to avoid unintended pregnancy. However, evidence regarding the multilevel factors linking past experiences of unintended pregnancy with covert contraceptive use is limited. The objective of this study was to identify the compositional and contextual factors associated with covert contraceptive use among women with a prior unintended pregnancy. Framed by the socio-ecological model, a cross-sectional study was conducted using data from Round 5 of the Performance Monitoring and Accountability 2020 project in Nigeria. Non-pregnant women aged 15–49 years who reported a previous mistimed or unwanted pregnancy were included (N = 1631). Multilevel logistic regression models with random intercepts were specified to investigate the relationship between covert contraceptive use and compositional and contextual factors. Approximately 4.54% (95% CI = 3.28–6.25) of women reported covert contraceptive use. At the individual level, having less than secondary education (aOR = 5.88, 95% CI = 1.20–28.72) and being single (aOR = 11.29, 95% CI = 2.93–43.56) were associated with higher odds of covert contraceptive use. There was no significant association between covert contraceptive use and the type of unintended pregnancy (mistimed: aOR = 3.13, 95% CI = 0.88–11.13). At the community level, living in a community with average poverty levels (aOR = 6.18, 95% CI = 1.18–32.55) and high exposure to family planning mass media (aOR = 6.84, 95% CI = 1.62–29.11) were associated with higher odds of covert contraceptive use. Measures of variation showed significant variation in covert contraceptive use across communities. Further research is warranted to better understand the underlying mechanisms in these observed associations and variations in covert contraceptive use among women following the experience of an unintended pregnancy. Additionally, there is a need to design family planning strategies that integrate community-level structures.

Keywords: Unintended pregnancy; contraception; covert use; Nigeria; multilevel

Introduction

Over the last few years, there is growing interest in understanding the role and impact of men in women's contraceptive agency and reproductive choice (Gasca and Becker., 2018). Evidence suggests that partner control and preferences strongly influence couple's fertility and contraceptive behaviours especially in sub-Saharan Africa (SSA) (Biddlecom and Fapohunda, 1998; Dozier *et al.*, 2022). While greater male involvement in family planning (FP) can enhance

the achievement of FP goals at the individual, family, and community levels, it may also conflict with women's fertility preferences and reproductive autonomy (Biddlecom and Fapohunda, 1998; Dozier *et al.*, 2022). In such situations, women may resort to using contraceptives without their partner's knowledge – a behaviour referred to as covert contraceptive use – particularly when there is a strong desire to space or limit pregnancies in the face of partner opposition (Biddlecom and Fapohunda, 1998; Dozier *et al.*, 2022; OlaOlorun *et al.*, 2020).

Covert contraceptive use often reflects women's reproductive agency, enabling them to achieve reproductive goals such as timing contraceptive use and choosing preferred methods (Sarnak and Gemmill, 2022). However, it may also indicate power imbalances within relationships. Factors such as limited spousal communication about contraception, discrepancies in fertility preferences, and unequal decision-making dynamics contribute to covert contraceptive use (Biddlecom and Fapohunda, 1998; Sarnak and Gemmill, 2022). Despite being underreported and understudied (Sarnak and Gemmill, 2022), covert contraceptive use remains prevalent across various social contexts in SSA (Kibira *et al.*, 2020). Its prevalence, however, varies depending on the methods of measurement and the specific populations studied (e.g., all women vs. only contraceptive users) (Sarnak and Gemmill, 2022).

Covert contraceptive use can be assessed using either direct or indirect methods. In population-based surveys such as the Demographic and Health Surveys (DHS) and Performance Monitoring for Accountability 2020 (PMA2020), the direct method involves determining whether a woman's partner is aware of her contraceptive use. The indirect method, in contrast, evaluates the concordance between the woman's report of modern contraceptive use and her partner's report of nonuse (Choiriyyah (Choiriyyah and Becker, 2018).

While the direct method may yield more accurate and reliable measures, it raises concerns about whether women would disclose contraceptive use to an interviewer when their partner is unaware (Gasca and Becker., 2018). Consequently, Choiriyyah and Becker (2018) suggest that direct measures may underestimate the true prevalence of covert contraceptive use, whereas the indirect method may lead to overestimation.

Existing evidence suggests a prevalence of covert contraceptive use ranging between 6-20% in earlier studies (Biddlecom and Fapohunda, 1998). More recent research employing both qualitative and quantitative approaches has provided further insights into the prevalence and determinants of covert contraceptive use in SSA. For instance, a study by OlaOlorun *et al.* (2020) using the direct method found that 4.5% of Nigerian women in need of FP, including both users and nonusers of contraception, were using contraceptives covertly. Similarly, research by Sarnak *et al.* (2022) among partnered women using contraception across eight countries in SSA and India reported prevalence rates ranging from 1% in India to 16% in Burkina Faso. In Nigeria, this study identified regional variations, with prevalence rates of 4.9% in Kano (North West) and 9.0% in Lagos (South West). Another study conducted in Ethiopia estimated a prevalence of 7.2% among partnered women using contraception (Dozier *et al.*, 2022).

In a study by Choiriyyah and Becker (2018), the prevalence of covert contraceptive use among modern contraceptive users was estimated to range between 2%–69% across 21 SSA countries. Temporal trends based on Indirect Estimation of Covert Use among monogamous couples in nine SSA countries, as analysed by Gasca and Becker (2018), indicated a prevalence of 8–34% in earlier surveys and 12–47% in later surveys, suggesting an overall increase in covert use over time. Similarly, a study using DHS data from eight African countries found that the prevalence of covert use was generally higher in West Africa compared to East Africa, ranging from 5.4% in Zambia to 30% in Sierra Leone (Sarnak and Gemmill, 2022). This study also reported a prevalence of 17% in Nigeria.

Experiences of negative consequences related to covert contraceptive use often stem from a partner's discovery or fear of discovery. These include reduced emotional support and financial backlash from partners, marital discord, intimate partner violence, emotional distress, and social sanctions (Dozier *et al.*, 2022; Sarnak and Gemmill, 2022; Sarnak *et al.*, 2022). Furthermore,

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women using contraceptives covertly are less likely to seek medical attention or switch methods when experiencing side effects (Choiriyyah and Becker, 2018). In contexts where spousal communication about contraceptive use is limited, qualitative research has shown that covert contraceptive use may serve as a strategy to avoid unplanned pregnancies, relationship conflicts, and violence (Biddlecom and Fapohunda, 1998; Sarnak and Gemmill, 2022; Wood *et al.*, 2023). However, partner discovery often results in discontinuation of contraceptive use (Dozier *et al.*, 2022). Despite these challenges, covert contraceptive use remains a means for some women to exercise reproductive autonomy.

Although there is growing interest in understanding covert contraceptive behaviours, the extent to which having an unintended pregnancy influences women's likelihood of using contraceptives covertly remains unclear. Gasca and Becker (2018) have emphasized the importance of studying covert contraceptive use given its associated consequences. This is particularly relevant in SSA, where entrenched gender norms often result in men exerting significant power and influence, promoting pronatalist behaviours that can restrict women's reproductive agency (Dozier *et al.*, 2022; Kibira *et al.*, 2020; Sarnak *et al.*, 2022). Guided by the socio-ecological framework, which links factors operating across multiple levels of socio-ecological systems, this study examines the factors associated with covert contraceptive use among women aged 15–49 years who have experienced a recent unintended pregnancy. The research questions guiding this study are as follows:

1. What individual-/household-level and community-level factors are associated with covert contraceptive use among women with a previous unintended birth?
2. Taking individual and household factors into account, to what extent do community-level factors explain covert contraceptive use among women with a previous unintended birth?
3. Are there community-level variations in the prevalence of covert contraceptive use?
4. Do variations in covert contraceptive use across communities persist after adjusting for individual and community effect?

The hypothesis is that, among women aged 15–49 years with a previous unintended pregnancy (either mistimed or unwanted), contextual characteristics such as community-level poverty, will have a significant association with covert use of contraceptives even after controlling for individuals' compositional characteristics.

Theoretical framework

Generally, behaviour theories are helpful in identifying and understanding the relationships among factors associated with prevention behaviours and related outcomes. This study will draw upon constructs of the Traits-Desire-Intention-Behaviour (TDIB) framework and the social-ecological model (SEM) to guide the methodology and analytic approaches employed in this study. Both theories are robust in explaining fertility motivations and reproductive decision-making. The TDIB framework was proposed by Miller (1994) and comprises the motivational and behavioural sequence involved in fertility and childbearing. It integrates theories of childbearing behaviours with microeconomic models of fertility and the theory of reasoned action (Barber *et al.*, 2021). This model posits that psychobiological factors, referred to as motivational traits, inform a rational desire for or against childbearing. This desire is then transformed into intentions, reflecting an individual's plan to engage in behaviour that either favours conception (proceptive behaviour) or prevents conception (contraceptive behaviour) (Miller and Pasta, 2002). Thus, while desires reflect what people want to do, intention on the other hand indicates what they plan to do (Mynarska and Rytel, 2020).

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The SEM, proposed by Bronfenbrenner (1977), posits that individual behaviours and decision-making, such as contraceptive use, are determined by dynamic interactions among various factors operating at multiple levels. These levels of influence, defined in various ways, typically include intrapersonal, interpersonal, community, and policy levels (Blodgett *et al.*, 2018). Given that women's efforts to prevent pregnancy are influenced by partner/dyad characteristics and community interactions, the SEM provides a compelling lens to explore contextual influences on covert contraceptive use. The utility of this model in examining such behaviours has been acknowledged by Sarnak and Gemmill (2022) and Tsui *et al.* (2010).

Methods

Study design and setting

This study was conducted in 2023 and was a cross-sectional analysis using data drawn from a nationally representative sample from Round 5 of the Nigeria Performance Monitoring and Accountability 2020 (PMA2020) survey. The PMA2020 survey is a subnationally or nationally representative surveys conducted either bi-annually or annually and collects data on FP and other reproductive health indicators from households, females 15–49 years and service delivery points (SDP). The household and women's questionnaires addressed topics such as household characteristics, assets, sanitation, fertility, and contraceptive use. The SDP questionnaires gathered information on facility attributes, including type, location, staffing, and capacity, measured by the number of beds. The PMA2020 project was succeeded by Performance Monitoring for Action (PMA), which began collecting longitudinal data in 2019, where panels of women are followed from one annual round to the next (https://www.pmadata.org). The PMA2020 survey is a smartphone-assisted survey which employs a multi-stage stratified cluster sampling design to collect data. Data were collected by female resident enumerators residing within or near the enumeration areas selected as study sites.

Households to be sampled were selected using three-stage cluster sampling. In first stage, states are selected from geopolitical zones using probability proportional to size (PPS) sampling with one state from five out of the six geopolitical zones and two from the North West Zone which contains 25% of the total population in Nigeria. In the second stage, 302 clusters (enumeration areas) within each state were selected from the National Population Commission's Census master sampling frame from 2006 using PPS (Hennegan *et al.*, 2021). From each enumeration area, 35–40 households were randomly selected (OlaOlorun *et al.*, 2020). This study used data from the Nigeria PMA2020 survey female dataset, which sampled 10,070 households and 11,106 females. Survey sample weights were included in the dataset to account for the sampling design. Ethical approval for the survey was granted by the Johns Hopkins Bloomberg School of Public Health and the National Health Research Ethics Committee of Nigeria. Verbal consent was obtained from all participating women. PMA2020 data are publicly available upon request (https://www.pmadata.org). The protocol for this study was reviewed and deemed exempt by the Institutional Review Board at the University of South Florida (IRB ID: STUDY005438).

Sample

In Round 5 of PMA2020 survey, 1795 nonpregnant women aged 15–49 years reported their most recent pregnancy as unintended – either mistimed or unwanted. Women were further excluded if they were missing data on covert contraceptive use ($n = 72$), wealth quintile ($n = 13$), religion ($n = 13$), marital status ($n = 13$), exposure to FP mass media ($n = 6$), parity ($n = 3$), and survey weights ($n = 31$). The resulting analytic sample comprised 1631 women nested in 277 clusters. The resulting analytic sample comprised 1631 women nested in 277 clusters. After adjusting the sample weight and cluster sampling design, the weighted size of the study sample was 1533.

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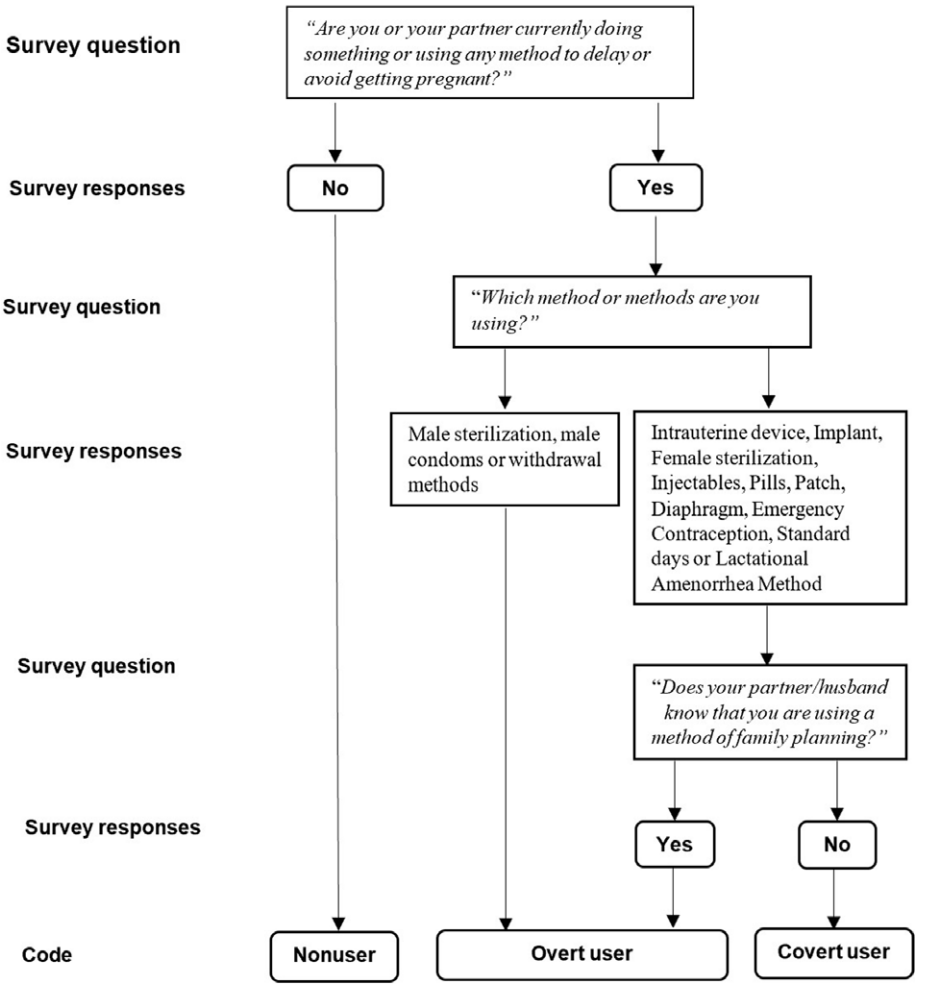

Figure 1. Schematic Representation of the Operationalization of Family Planning Use Dynamics in the Current Study.

Measures

Dependent variable

The outcome of interest was a form of contraceptive behaviour operationalized as a polytomous variable (nonuse, overt, or covert) similar to prior studies (OlaOlorun *et al.*, 2020; Wood *et al.*, 2023). The direct approach was used to define this outcome based on three questions asked during the PMA survey as shown in Figure 1. The first question asked question '*Are you or your partner currently doing something or using any method to delay or avoid getting pregnant?*' with '*yes*' or '*no*' responses. Women who answered '*no*' were classified as nonusers. Women who answered '*yes*' were asked '*Which method or methods are you using?*' in order to determine the method of contraception being used. Thereafter, women were asked '*Does your partner/husband know that you are using a method of family planning?*'. Women who answered '*no*' were categorized as covert users while those answering *yes* were classified as overt users. In addition, women who stated they were using either male sterilization, male condoms, or withdrawal methods were considered overt users. The dependent variable, covert contraceptive use, was coded as follows: '0' for overt contraceptive use, '1' for nonuse of contraception and '2' for covert contraceptive use.

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Independent variables

The variables used as covariates in the models were identified based on a comprehensive literature review, an evaluation of their biological plausibility in the exposure-outcome relationship and the availability of variables in the survey data. Based on the SEM (Sipsma *et al.*, 2012), these variables were classified into compositional (individual and household) and contextual (community) level factors. The individual-level factors comprised the woman's age at the time of the survey (15–24 years, 25–34 years and 35–49 years), highest schooling level (less than secondary, secondary, higher than secondary), parity (1-2, 3-4, 5+), pregnancy intention (mistimed, unwanted), fertility intention (want another child, want to delay, want to stop), and exposure to FP mass media (exposed and not exposed) based on women reporting exposure to FP messages through at least one media channel (radio, television, newspapers, billboards/posters, magazines, brochure/leaflet, flyer, voice, or text message), religion (Christian, Non-Christian), married or in union (yes, no) household wealth index (poorest, poorer, middle, richer, richest).

Community-level factors included place of residence (urban or rural), geographic region of residence (North Central, North East, North West, South East, South South, South West), community-level literacy, community-level poverty, and community-level exposure to FP mass media. While the PMA survey records the place and region of residence for participants, it does not directly collect data on these additional community-level characteristics. Therefore, for each cluster, individual-level responses were aggregated for variables such as education level, household wealth index, and exposure to FP mass media to create community-level measures. Specifically, community-level literacy was determined by calculating the proportion of women in a cluster who had attained secondary education or higher. Community-level poverty was derived by calculating the proportion of women living in the poorest (quintile 1) or poorer (quintile 2) households within each cluster while community-level exposure to FP mass media was determined by calculating the proportion of women in a cluster who were exposed to at least one form of FP mass media. These community-level variables were then categorized into tertiles to represent low, average, and high levels for each characteristic based on their distribution across the clusters.

Statistical analysis

Data analysis was performed using SAS version 9.4. Weighted descriptive statistics using the relevant SAS procedures, including weighted means and standard errors for continuous variables (SURVEYMEANS) and frequencies and percentages for categorical variables (SURVEYFREQ), were reported separately for covert use of a contraceptive method to describe the background characteristics of survey respondents using the SAS survey procedures to calculate valid estimates of the standard errors based on the survey design. Additionally, Rao-Scott chi-square test was used to test differences between covert contraceptive use and individual- and community-level characteristics.

Model building strategy

Given the hierarchical structure of the data from the PMA survey, with women (i) nested within enumeration areas (j) and considering the polytomous nature of the outcome variables ($n = 3$), several two-level multinomial logistic regression models with a random intercept were fitted. The PROC GLIMMIX procedure with a multinomial distribution and the GLOGIT link function were used (Ene *et al.*, 2015). The pseudo-maximum likelihood approach with adaptive quadrature (METHOD = QUAD) was employed to estimate model parameters while the degrees of freedom for the fixed effects were calculated by specifying the CONTAINMENT option (DDFM = CONTAIN). For the estimation of level-2 errors, specifically the G-matrix in the covariance matrix, the TYPE=VC option was used. This option assumes a simple structure where separate variances are estimated, without considering covariances (Ene *et al.*, 2015). To reduce bias in the

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variance parameter estimate, the raw community-level (level-2) weights contained in the dataset along with the scaled individual-level (level-1) weights were used, as recommended by Lin *et al.* (2012) and Rabe-Hesketh and Skrondal (2006).

The multilevel analytic strategy employed in this study involved fitting three models including a null model. The null (empty) model, which excluded both individual and community-level variables, was defined for the purpose of quantifying random intercept variation and calculating the intraclass correlation coefficient. Thereafter, more complex conditional models were developed. Model I incorporated only individual-level characteristics, while Model II considered only community-level characteristics. The final model, Model III, adjusted for both individual and community-level variables simultaneously. Fixed effects were presented as odds ratios (ORs) with their respective 95% confidence intervals (CIs). All tests were two-tailed and p-values < 0.05 were considered statistically significant. However, only the null and full models are presented in this analysis. Given the exploratory nature of this paper, it is important that the effect estimates from the models are interpreted as mutually adjusted associations rather than causal relationships.

Measures of random variation were estimated using the intraclass correlation coefficient (ICC), the median odds ratio (MOR), and the percentage change in variance (PCV). The ICC quantifies the proportion of total observed variability in covert contraceptive use that can be attributed to between-community variability (Austin and Merlo, 2017). The within-community variance in logistic regression models is represented by the variance of the standard logistic distribution. By using the logistic distribution variance of approximately 3.29 (or $\pi^2/3$), the ICC is computed using the formula:

$$\text{ICC} = [\tau_{00}/(\tau_{00} + 3.29)], \text{where } \tau_{00} \text{ is the between-community variance}$$

The MOR, on the other hand, quantifies the variability in the odds of covert contraceptive use between communities within the study sample. In the context of this study, the MOR describes the median value of the odds ratio when comparing the odds of the covert contraceptive use between two randomly selected communities (Austin and Merlo, 2017; Merlo *et al.*, 2009). It is calculated using the formula:

$$\text{MOR} = \exp\left[\sqrt{2 \times \tau_{00} \times 0.6745}\right] = \exp\left[0.95\sqrt{\tau_{00}}\right], \text{ where } 0.6745 \text{ is the } 75^{\text{th}} \text{ percentile of the cumulative distribution function of the normal distribution.}$$

The proportional change in variance (PCV) estimates the variation explained by the multilevel models (Austin and Merlo, 2017). In this case, the τ_{00} value for conditional models (Models III) is compared to that of the null model $[\tau_{00(0)} - \tau_{00(n-1)/} \tau_{00(0)}]$. The Akaike information criterion (AIC) and the Bayesian information criterion (BIC) were used to evaluate the goodness of fit for these models. Smaller AIC and BIC values indicate better model fit, offering a measure of model performance.

Results

Sociodemographic and health-related characteristics

The study population included a total of 1631 women (representing a weighted population of 1533 women) whose most recent pregnancy was reported as either mistimed or unwanted and nested in 277 communities. The mean age of the women in the study was 32.9 years (SD = 8.3). At the individual level, covert contraceptive use was more prevalent among women aged 35-49 years, those with a secondary level of education, women with high parity, single women, those with a recent mistimed pregnancy and no desire for further children, individuals not exposed to FP mass media, residents of poorer households, and those affiliated with Christianity (Table 1). In terms of community-level characteristics (Table 2), women residing in rural areas and those residing in the

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Table 1. Weighted Distribution of Covert Contraceptive Use by Individual-Level Characteristics, PMA2020, 2018

	Total sample (N = 1533, % = 100)		**Nonuse** (N = 950, 62.02%)		**Overt use** (N = 512, 33.44%)		**Covert use** (N = 70, 4.54%)		
Variables	*N*	%	*N*	%†	*N*	%†	*N*	%†	*p*-value
Maternal age									
15–24	286	13.95	226	73.67	52	22.84	8	3.49	0.049
25–34	611	37.69	390	60.99	195	34.72	26	4.28	
35–49	734	48.34	470	59.47	225	35.46	39	5.06	
Highest schooling level									
Less than secondary	801	43.42	637	76.46	130	18.79	34	4.74	<.0001
Secondary	626	40.46	362	55.38	233	39.69	31	4.92	
Higher than secondary	204	16.12	87	39.83	109	57.09	8	3.09	
Parity									
1-2	501	31.93	347	65.06	130	29.92	24	5.01	0.13
3-4	460	28.33	298	58.83	148	38.64	14	2.54	
5+	670	39.73	441	61.87	194	32.53	35	5.59	
Married/cohabiting									
No	255	17.57	185	71.47	46	20.11	24	8.42	0.0003
Yes	1376	82.43	901	60.02	426	36.26	49	3.72	
Pregnancy intention									
Mistimed	1164	68.75	790	64.17	324	31.09	50	4.73	0.12
Unwanted	464	31.25	296	57.31	148	38.55	23	4.14	
Fertility preferences									
Undecided	208	12.77	161	71.62	42	24.04	5	4.04	0.005
Yes	785	44.09	551	66.66	205	29.64	29	3.69	
No	638	43.13	374	54.45	225	40.07	39	5.47	
Exposure to FP mass media									
Not exposed	435	28.11	320	74.12	95	21.24	20	4.64	<0.0001
Exposed	1196	71.89	766	57.31	377	38.19	53	4.55	
Household wealth index									
Poorest (quintile 1)	544	28.77	446	79.74	85	17.65	13	2.62	<0.0001
Poorer	413	21.13	283	69.21	98	23.28	32	7.50	
Middle	276	18.41	172	60.63	92	35.19	12	4.18	
Richer	222	16.84	103	42.61	109	51.65	10	5.74	
Richest	176	14.83	82	42.27	88	55.57	6	3.15	
Religion									
Christian	797	57.96	436	52.43	319	42.10	42	5.47	<0.0001
Non-Christian	834	42.04	650	75.26	153	21.46	31	3.27	

Notes: Counts (*N*) are unweighted while percentages (%) are weighted for the survey's complex sampling design.
Abbreviations: FP = Family Planning.
p-values are based on Rao-Scott chi-square test.
†Weighted row percentage. Percentage may not sum to 100 due to missing values or rounding.

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Table 2. Weighted Distribution of Covert Contraceptive Use by Community-Level Characteristics, PMA2020, 2018

	Contraceptive use								
	Total sample		Nonuse (N = 1086, 62.9%)		Overt use (N = 472, 33.4%)		Covert use (N = 73, 4.5%)		
Variables	1631	100	*N*	%†	*N*	%†	*N*	%†	*p*-value
Place of residence									
Rural	942	48.06	702	73.09	208	23.68	32	3.23	<0.0001
Urban	689	51.93	384	51.79	264	42.45	41	5.76	
Geographic region									
North Central	196	12.60	141	69.88	44	25.14	11	4.98	<0.0001
North East	144	15.96	111	73.13	26	21.74	7	5.13	
North West	751	26.17	571	78.05	157	19.55	23	2.38	
South East	164	9.84	82	40.45	72	50.81	10	8.75	
South South	194	17.96	93	50.79	194	42.69	17	6.52	
South West	182	17.46	88	45.90	89	51.57	5	2.53	
Community-level literacy									
Low	544	25.52	465	84.38	68	13.85	11	1.77	<0.0001
Average	571	36.53	371	63.22	170	32.08	30	4.71	
High	516	37.96	250	45.86	234	47.88	32	6.25	
Community-level poverty									
Low	478	38.32	248	49.01	213	47.19	17	3.79	<0.0001
Average	531	31.97	327	60.68	162	31.96	42	7.36	
High	622	30.71	511	79.64	97	17.73	14	2.63	
Community-level FP media exposure									
Low	525	32.57	389	74.41	121	21.91	15	3.68	<0.0001
Average	522	37.48	340	60.64	159	35.85	23	3.49	
High	584	29.93	357	50.29	192	42.92	35	6.78	

Notes: All estimates are weighted for the survey's complex sampling design.
†Weighted row percentage. Percentage may not sum to 100 due to missing values or rounding.
p-values are based on Rao-Scott chi-square test.

South East region. Furthermore, covert contraceptive use was more prevalent in communities with high literacy levels, average poverty level, and high exposures to FP mass media.

In the study sample, approximately 4.54% reported using contraceptive methods covertly. Overall, 545 (38%) women were using a contraceptive method (covert = 11.97%; overt: 88.03%). Of these, 13.19% of those who reported a mistimed pregnancy and 9.69% of those who reported an unwanted pregnancy were using contraceptives covertly. Figure 2 shows the unweighted distribution contraceptive method used across the different outcome categories and by pregnancy intention. Among women using contraceptives covertly, 25.79% used implants, followed by pills (25.78%) and injectables (14.57%). The least used contraceptive method was intrauterine device (4.73%). Additionally, among women using contraceptive methods covertly ($n = 70$), those who experienced a mistimed pregnancy were more likely to use various contraceptive methods compared to those who had an unwanted pregnancy, with the exception of IUDs, which were more likely to be used by women who had an unwanted pregnancy (Figure 3).

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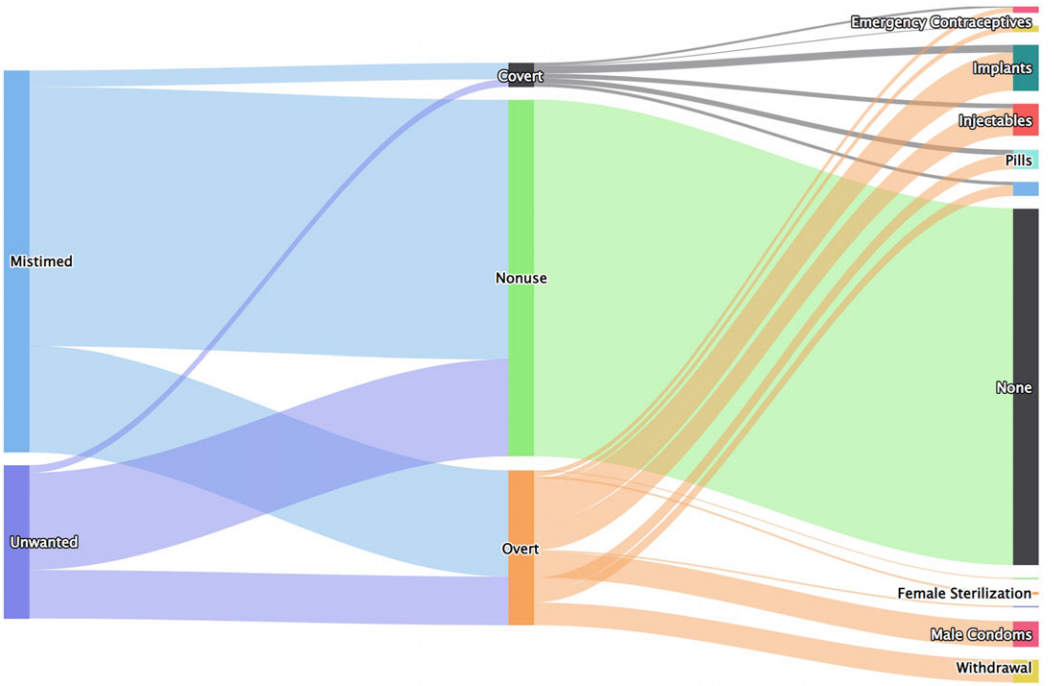

Figure 2. Contraceptive Method Choice by Form of Use and by Pregnancy Intendedness.

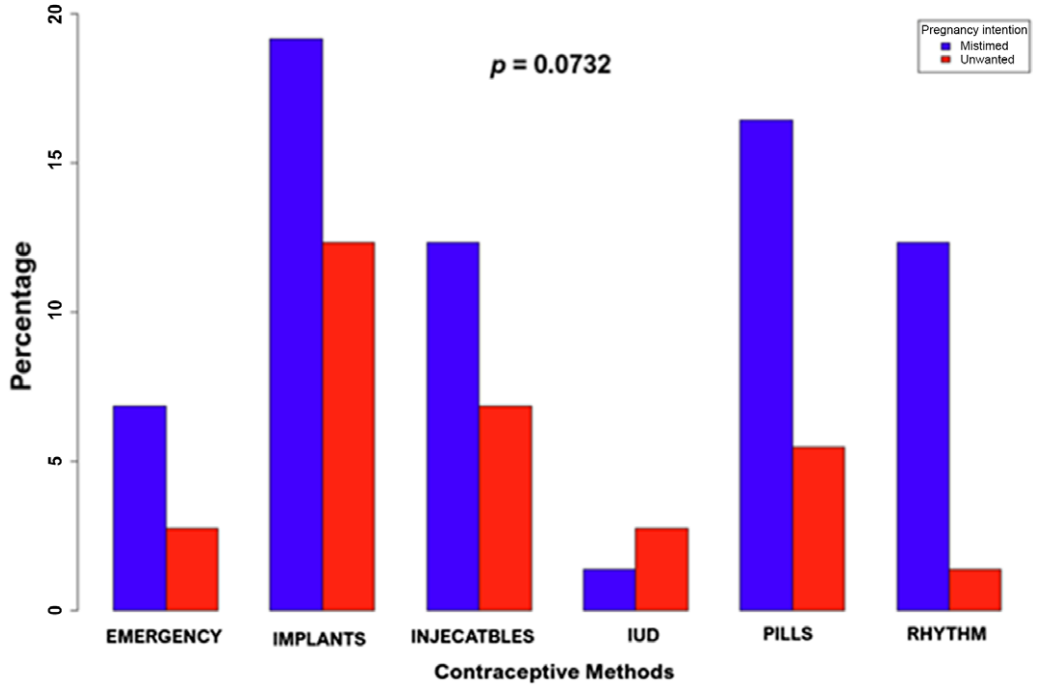

Figure 3. Contraceptive Method Used Covertly by Pregnancy Intendedness.

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Multilevel logistic regression

Fixed effects (measure of association) results

Based on the null model, the odds of covert and nonuse of contraceptives among women who experienced a prior unintended pregnancy at a typical community were 0.02 and 1.70, respectively. This indicates that the probability of using contraceptives covertly was 0.7% and 62.2% for contraceptive nonuse contraceptive use. Educational status of women, marital status, household wealth index, community-level poverty, community-level literacy, and exposure to FP mass media were associated with covert contraceptive use.

Based on the model fit information (Table 3), the full model (Model III) was the best-fitting model for the data and therefore, used to address the objectives of this study. At the individual level, women whose educational status was less than secondary school had significantly higher odds of covert contraceptive use (aOR = 5.88, 95% CI = 1.20–28.72) compared to women who had higher than a secondary level of education. Similarly, women who were not married or cohabiting had an 11-fold higher odds of covert contraceptive use (aOR = 11.29, 95% CI = 2.93–43.56). While women who had a mistimed pregnancy were more likely to be using covertly than overtly compared to their counterparts who had unwanted pregnancy, this relationship was not statistically significant (mistimed: aOR = 3.13, 95% CI = 0.88–11.13).

Regarding community-level characteristics, women residing in communities with average household poverty levels had a sixfold higher odds of reporting covert contraceptive use compared to those living in communities with low household poverty levels (aOR = 6.18, 95% CI = 1.18–32.55). Furthermore, women living in communities with high exposure to FP mass media were positively and significantly more likely to use contraceptives covertly (aOR = 6.84, 95% CI = 1.62–29.11) compared to those residing in communities with low exposure to FP mass media.

Random effects (measure of variation) results

Table 4 shows the results of the random effects from the weighted multilevel multinomial logistic regression analysis. The probability of covert contraceptive use varied significantly across communities (covert use: $\tau_{00} = 4.57$, SE = 1.46, z(573.2) = 3.12, $p = 0.0009$). Based on the results of the null model, the ICC for covert use was 0.58 (58% of the total variability in the odds of covert contraceptive use was attributed to differences across communities). This indicates that contextual factors significantly influence women's covert contraceptive use. As shown in the null model, if a woman moved to a community with a higher probability of covert contraceptive use, her likelihood of using contraceptives covertly would increase by 7.68 times (MOR = 7.68). In Model III (the best-fitting model), the MOR was reduced to 4.89, suggesting that after accounting for individual and household characteristics, community-level factors explained only a small portion of the remaining variation in covert contraceptive use.

Furthermore, based on the estimated PCV, relative to the null model, 11.28% of the variance in the likelihood of covert contraceptive use was explained by including only individual and household-level characteristics in the model (Model I). In the best-fitting model (Model III), approximately 39.25% of the variability in the odds of covert contraceptive use, compared to the null model, was accounted for by the individual, household, and community-level characteristics incorporated in the analysis.

Discussion

This study extends the limited existing knowledge on the extent and determinants of covert contraceptive use following an unintended pregnancy among women in SSA. The primary objective of this study was to identify compositional and contextual factors associated with covert contraceptive use among a nationally representative sample of women in Nigeria who had

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Table 3. Association Between Individual and Community Characteristics and Forms of Contraceptive Use in Nigeria: Multinomial Multilevel Analysis, PMA2020 2018, N = 1631[a]

	Covert use (*N* = 73)		Nonuse use (*N* = 1086)	
	aOR	95 CI	aOR	95 CI
Intercept[b]	**-8.03****		**3.39****	
Individual characteristics				
Maternal age				
15–24	Ref	–	Ref	–
25–34	2.04	0.34–12.18	0.48	0.21–1.13
35–49	1.85	0.29–12.01	0.43	0.09–2.07
Highest schooling level				
Higher than secondary	Ref	–	Ref	–
Secondary	3.42	0.59–19.88	1.83	0.90–3.69
Less than secondary	**5.88**	**1.20–28.72***	**2.69**	**1.23–5.86***
Parity				
1-2	Ref	–	Ref	–
3-4	0.77	0.19–3.17	1.49	0.39–5.70
5+	2.57	0.54–12.25	1.33	0.37–4.82
Married/cohabiting				
Yes	Ref	–	Ref	–
No	**11.29**	**2.93–43.56****	**9.95**	**2.94–33.66****
Pregnancy intention				
Mistimed	Ref	–	Ref	–
Unwanted	3.13	0.88–11.13	**2.90**	**1.05–8.06***
Fertility preferences				
No	Ref	–	Ref	–
Yes	0.49	0.13–1.93	0.55	0.13–2.32
Undecided	0.74	0.15–3.74	0.41	0.08–2.02
Exposure to FP mass media				
Not exposed	Ref	–	Ref	–
Exposed	0.67	0.24–1.87	0.51	0.25–1.06
Household wealth index				
Poorest	Ref	–	Ref	–
Poorer	1.42	0.32–6.28	0.36	0.11–1.18
Middle	0.87	0.16–4.83	0.55	0.23–1.32
Richer	0.81	0.16–4.09	**0.24**	**0.07–0.77***
Richest	1.42	0.14–14.32	**0.25**	**0.07–0.86***
Religion				
Christian	Ref	–	Ref	–
Non-Christian	1.09	0.30–3.99	0.47	0.15–1.45

(*Continued*)

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Table 3. (*Continued*)

	Covert use ($N = 73$)		Nonuse use ($N = 1086$)	
	aOR	95 CI	aOR	95 CI
Place of residence				
Rural	Ref	–	Ref	–
Urban	3.28	0.92–11.68	1.07	0.51–2.24
Community characteristics				
Geographic region				
North Central	Ref	–	Ref	–
North East	0.47	0.03–7.91	0.42	0.09–1.93
North West	0.18	0.02–1.61	1.05	0.43–2.55
South East	0.64	0.06–6.84	0.62	0.19–2.04
South South	0.67	0.07–6.09	1.16	0.37–3.61
South West	0.11	0.01–1.42	0.65	0.20–2.10
Community-level literacy				
Low	Ref	–	**Ref**	**–**
Average	1.23	0.20–7.55	**0.33**	**0.13–0.84***
High	1.90	0.23–15.96	**0.20**	**0.06–0.68***
Community-level poverty				
Low	Ref	–	Ref	–
Average	**6.18**	**1.18–32.55***	0.51	0.22–1.17
High	7.73	0.65–91.95	0.66	0.17–2.49
Community-level FP mass media exposure				
Low	Ref		Ref	
Average	0.98	0.21–4.53	0.84	0.38–1.83
High	**6.84**	**1.62–29.11****	0.68	0.25–1.86

Note: Shown are adjusted odds ratios (aORs) and 95% confidence intervals (CI). Statistically significant ORs ($p < 0.05$) are bolded. Model adjusted on all individual and community characteristics presented in Table 3.
Abbreviations: FP = Family Planning.
Estimation Method = Quadrature.
[a]Best-fitting model.
[b]Estimates are presented as log odds.
Values based on SAS PROC GLIMMIX.
Scaling method 2 used for level 1.
Reference for outcome = Overt use.
*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

experienced an unintended pregnancy. The findings from this study revealed that nearly 1 in 20 women with a prior unintended pregnancy were using contraceptives covertly. Among those currently using a contraceptive method, approximately 1 in 9 were using it covertly. Additionally, 13.19% of women who reported a mistimed pregnancy and 9.69% of those who reported an unwanted pregnancy were using contraceptives covertly.

While evidence from observational studies among a similar population used in this study is lacking, this prevalence in this study is consistent with that found in other observational studies across different contexts in SSA where the prevalence ranges between 2.6%–20.2% (Akoth *et al.*, 2021). In Nigeria, a study by Sarnak and Gemmill (2022) revealed the prevalence of covert use

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Table 4. Results from the Random Intercept Model Using Multinomial Multilevel Regression Models

	Null Model		Model I		Model II		Model III	
Random effects	Covert	Nonuse	Covert	Nonuse	Covert	Nonuse	Covert	Nonuse
Cluster-level variance (SE)	4.57 (1.46)	2.65 (0.83)	4.07 (1.48)	1.89 (0.62)	2.46 (0.86)	1.27 (0.50)	2.78 (1.00)	1.53 (0.53)
ICC (%)	58.14	42.30	55.19	36.57	42.82	27.97	45.76	31.77
MOR	7.68	4.73	6.82	3.72	4.47	2.93	4.89	3.23
Explained variance (PCV, %)	Reference	Reference	11.28	28.58	46.05	51.86	39.25	42.30
Model fit summary								
AIC	2984.23		2581.53		2894.08		2569.25	
BIC	2998.73		2712.00		2995.55		2786.69	
Deviance	2976.23		2509.53		2838.08		2449.25	

Abbreviations: Akaike information criterion Note. SE = Standard Error; CI = Confidence Interval.; PCV = Percentage Change in Variance; ICC is the inter-cluster correlation coefficient.

among women in Nigeria was 17%. This prevalence is also likely to vary by geographical region as Sarnak *et al.* (2022) in another study showed North-South differences in covert use (Kano, 4.9% vs Lagos, 9.0%). Both studies were, however, restricted to women who were using a modern contraceptive method at the time of the survey compared to the present study which included both users and nonusers of contraception. While previous studies indicate that the general population of women who use contraceptives covertly used mostly used injectables (Akoth *et al.*, 2021; Baiden *et al.*, 2016), this study found that implants, followed by pills, were the most commonly used contraceptive methods among women with a history of unintended pregnancy. This observation aligns with findings from several countries across SSA, as reported by Sarnak and Gemmill (2022).

At the individual level, marital status was observed to be associated with convert contraceptive use among women who had a prior unintended pregnancy. Interestingly, women with a history of unintended pregnancy who were not married or cohabiting showed a stronger tendency towards using contraceptives covertly compared to their married or cohabiting counterparts, which is consistent with findings in previous research conducted across different countries in SSA (Sarnak *et al.*, 2022), albeit, among the general population of women. While the reasons for this finding remain unclear, this could possibly reflect the complex interplay of the prevailing social, cultural, and individual norms influencing women's FP choices and reproductive autonomy. Furthermore, in many countries in Africa, it is considered culturally taboo for married women or women in stable relationships to use contraceptives without the knowledge of their spouses (John *et al.*, 2015). Another explanation could be that single women have a greater self-efficacy and thus, are able exercise some degree of control over their reproductive choices compared to married or cohabiting women. Hence, married or cohabiting women who experienced a prior unintended pregnancy and who cannot use contraceptives either covertly or overtly, face the risk of experiencing a repeat unintended pregnancy and short interpregnancy intervals.

Women in the sample with lower or no education were more likely to use contraceptives covertly compared to women with higher education, consistent with prior research findings (Baiden *et al.*, 2016; Sarnak *et al.*, 2022). Given that education is commonly associated with a high degree of empowerment, OlaOlorun *et al.* (2020) suggest that women who are dis- or less empowered are

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more likely to use contraception covertly. Relatedly, women with lower educational attainment may experience limitations in relationship and household decision-making authority. Therefore, engaging in covert contraceptive use may represent an opportunity for women with unintended pregnancies to exert their influence over their reproductive choices to control their fertility without encountering resistance from partners or family members.

This study indicates that the communities where women with a history of unintended pregnancies reside play a considerable role in predicting covert contraceptive utilization, even after adjusting for individual characteristics. Specifically, residing in communities with high levels of exposure to FP mass media and average poverty levels was strongly linked to increased odds of covert contraceptive use among the women in the study sample. This suggests that community-level factors exert considerable influence on women's decisions regarding covert contraceptive practices. Also, it is possible that communities with greater exposure to FP mass media may have stronger social norms and awareness regarding FP and contraception. This increased awareness could lead women to engage in the covert use of contraceptive methods, especially if they perceive social stigma or resistance from their spouse. The findings of this study highlight significant disparities in the likelihood of covert contraceptive use across different communities, underscoring the need to account for contextual influences when examining the impact of unintended pregnancy experiences on subsequent covert contraceptive behaviours.

This study supports the applicability of the TDIB framework in understanding covert contraceptive use among women, though the model showed only modest success in predicting which women with a prior unintended pregnancy were more likely to use contraception covertly. Further, this study leveraged data from a survey not originally designed to test the TDIB framework, and while relevant proxy variables were included, a key concern is the potential correlation between fertility preferences and pregnancy intendedness, which may have biased the estimates.

Despite these concerns, the findings from this study provide a theoretical basis for future studies to refine measures of the TDIB constructs, potentially improving model fit and offering additional insight into the mechanisms behind covert contraceptive use. Also, while general contextual effects suggest communities play a role in explaining variations in covert contraceptive use, specific factors like residence, geographic region, and literacy showed inconclusive results. However, factors such as exposure to FP mass media and poverty seem to influence the framework's ability to explain covert contraceptive behaviour. Notably, the cluster-level findings from this study may reflect Nigeria's broader social norms where gender inequity and power imbalances limit women's agency in contraceptive decisions. In such settings, husbands opposed to FP may restrict contraceptive use even after unintended pregnancies. Future research should explore community attitudes and norms around covert contraceptive use to better understand this phenomenon in the context of unintended pregnancy.

This study has several implications for public health research, policy and practice. Establishing unbiased patient-provider communication can effectively identify women experiencing unintended pregnancies who may be using contraceptives covertly. This, in turn, will enable women's health providers to develop tailored strategies to support these women and address their sexual and reproductive health needs more effectively. Also, FP policies and programs should not only focus on identifying women with unintended pregnancies who are at high risk of using contraceptives covertly but should also target high-risk communities where women are likely to use contraceptives covertly. This approach can provide the support needed for this subgroup of women to achieve their reproductive goals. Future studies with qualitative or mixed-method designs can provide understanding of the dynamics influencing women with unintended pregnancies in their decision to use contraceptives covertly, including potential differences among different categories of unintended pregnancy. Furthermore, recognizing the complexity of pregnancy intention as a multidimensional concept, using validated tools like the London

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Measure of Unplanned Pregnancy (LMUP) or alternative approaches such as assessing emotional responses to pregnancy can offer valuable insights into the variations in covert contraceptive use across the spectrum of pregnancy intentions.

There are several strengths of this study. Firstly, the sample in this study exclusively comprises a nationally representative sample of women who reported unintended pregnancies, further categorized into those with mistimed and unwanted pregnancies. This approach addresses an important limitation observed in previous studies where such distinctions are less often made. This allowed a nuanced understanding of how these distinct categories impact covert contraceptive use. Secondly, by employing a multi-theoretical approach, this study offers valuable insights into the role of both compositional and contextual factors in shaping covert contraceptive use among women with unintended pregnancies. Lastly, through the application of a multilevel modelling approach, this study not only provides estimates of the determinants of covert contraceptive use but also examines the extent to which using contraceptives covertly varies across different communities included in this analysis.

Several limitations of this study are also worth mentioning. While this analysis used nationally representative data, the relatively small sample size (covert users: 73/1631) potentially limits the extent to which the findings and conclusions can be extrapolated to the larger population. Additionally, because this study was restricted only to women who recently experienced unintended pregnancy, the extent to which covert contraceptive use differs from those who reported a recent pregnancy as intended was not compared, thus remaining an open question for future investigation. Importantly, this study relied on the timing-based method of ascertaining pregnancy intention. This approach is susceptible to recall bias as noted in previous studies (Blondel *et al.*, 2023; Zimmerman *et al.*, 2023). Furthermore, the combined influence of *ex post* rationalization could potentially introduce bias into the estimates related to this study. Similarly, the direct method employed to ascertain covert contraceptive use is likely to overestimate the true magnitude of covert use and ultimately affect the interpretation of the findings from the present study (Choiriyyah and Becker, 2018; Sarnak and Gemmill, 2022).

Conclusion

This study demonstrated a low but significant prevalence of covert contraceptive use among women who experienced a prior unintended pregnancy in Nigeria. This study's findings reveal several significant associations between theoretically important individual-level characteristics (such as education level and marital status) and community-level factors (including community-level poverty and exposure to FP mass media) with covert contraceptive use. Additionally, this study highlights substantial variation in these associations across different communities. Therefore, targeted educational interventions, focusing on women's empowerment, should be integrated into broader sexual and reproductive health programmes, taking into account the role of context. Furthermore, community-level interventions should aim to enhance women's contraceptive agency and expand their reproductive choices.

Data availability statement. The data set is publicly available and can be downloaded from https://mics.unicef.org/surveys.

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