

RESEARCH ARTICLE

Empowerment, sexual autonomy, and
contraceptive choices: Recent evidence from
Bangladeshi women

S. M. Mostafa Kamal^{1†*}, Md. Amanat Ullah^{2†}, Gazi Mahabubul Alam^{3†},
Md. Anisur Rahman¹, Rehnuma Ferdous⁴, Md. Shafiul Alam Chowdhury⁵, and
Mohammad Alauddin⁵

¹Department of Mathematics, Faculty of Sciences, Islamic University, Kushtia, Bangladesh

²Department of Mathematics, Faculty of Science and Engineering, Uttara University, Dhaka, Bangladesh

³School of Education, Faculty of Social Sciences and Leisure Management, Taylor's University Subang Jaya, Selangor, Malaysia

⁴Department of Economics, Faculty of Social Science, Jatiya Kabi Kazi Nazrul Islam University, Mymensingh, Bangladesh

⁵Department of Computer Science and Engineering, Faculty of Science and Engineering, Uttara University, Dhaka, Bangladesh

[†]These authors contributed equally to this work.

***Corresponding author:** S. M. Mostafa Kamal
(kamaliubd@yahoo.com)

Citation: Kamal SMM, Ullah MA, Alam GM, *et al.* Empowerment, sexual autonomy, and contraceptive choices: Recent evidence from Bangladeshi women. *International Journal of Population Studies*. <https://doi.org/10.36922/IJPS025160061>

Received: April 15, 2025

1st revised: August 8, 2025

2nd revised: August 23, 2025

3rd revised: September 2, 2025

Accepted: September 23, 2025

Published online: October 14, 2025

Copyright: © 2025 Author(s). This is an Open-Access article distributed under the terms of the Creative Commons Attribution License, permitting distribution, and reproduction in any medium, provided the original work is properly cited.

Publisher's Note: AccScience Publishing remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Abstract

In low- and middle-income countries, women's empowerment is a vital driver for overall development. Using data from the 2022 Bangladesh Demographic and Health Survey, this study investigates how women's household decision-making power and autonomy over sexual rights influence contraceptive method choice among married women in Bangladesh. Findings show that 59% of women used modern contraceptives, while 10% relied on traditional methods. Multilevel multinomial logistic regression (MLMLR) analysis reveals that women with higher household decision-making autonomy and those who supported the right to refuse sex with their husbands were significantly ($p < 0.001$) more likely to prefer either modern or traditional contraception compared to the reference category, "non-users." Moreover, older women, those from wealthier households, women desiring more children, and those who had experienced child mortality were significantly less likely to choose traditional or modern contraception compared to non-users. Conversely, the likelihood of preferring modern or traditional methods was significantly higher among highly educated couples, those earning cash income, non-Muslim women, those who received visits from family planning workers (FPWs), and those with access to mass media. Community-level factors also influenced contraceptive method choices: Urban women and those from communities with higher levels of female education were more likely to use contraceptives than their non-user counterparts. The MLMLR analysis also found significant variations in contraceptive method choice across clusters and regions. The findings underscore the critical role of women's empowerment, particularly in household decision-making and sexual autonomy, in shaping contraceptive behavior. Strengthening women's agency at both individual and community levels through policies and programs, expanding FPW doorstep services, and empowering low-educated, rural women in household decisions may boost effective contraceptive use and advance Bangladesh's family planning efforts.

Keywords: Bangladesh; Women's empowerment; Women's household decision-making autonomy; Contraceptive method choice; Multilevel multinomial logistic regression

1. Introduction

Women's empowerment is now recognized as a vital ingredient in shaping global development initiatives, especially in low- and middle-income countries (LMICs). Women's empowerment encompasses various dimensions, such as decision-making autonomy, financial independence, access to education, and reproductive and sexual rights. These factors significantly impact a woman's autonomy in making informed decisions regarding her reproductive health and rights, including contraceptive method use and method choice (Lahole *et al.*, 2024; Nkoka *et al.*, 2021). Family planning (FP) plays a vital role in helping women manage childbirth, prevent unintended pregnancies, create a suitable gap between successive childbirths, and enhance maternal and child health. While many countries, including Bangladesh, have made significant progress in increasing contraceptive use, disparities persist, emphasizing the need to explore the effect of women's empowerment on their reproductive behavior, particularly contraceptive use and method choice (Lahole *et al.*, 2024; Nkoka *et al.*, 2021).

Bangladesh has witnessed a remarkable shift in contraceptive use over recent decades. The prevalence of contraceptive methods has increased from just 8.0% in the mid-1970s to approximately 64.0% by 2022 (National Institute of Population Research and Training [NIPORT] *et al.*, 2024), with 54.7% using modern contraceptive methods and 9.3% relying on traditional methods. This achievement in expanding modern contraception is largely credited to proactive FP programs and increased awareness (Kamal & Islam, 2012). Despite these advancements, the continued prevalence of 19% unintended pregnancies and a 10% unmet need for FP among currently married Bangladeshi women, equally split between the desire to space and limit births, has critical implications for women's empowerment and their ability to make informed contraceptive choices. Although the persistent demand for FP points to widespread awareness and willingness to use contraceptives, the relatively small decline in unmet need, from 12% in 2017–2018 to 10% in 2022 (NIPORT *et al.*, 2024), highlights ongoing challenges. The high levels of unintended pregnancies and unmet demand for contraception suggest that improvements in access and decision-making autonomy remain limited. This ongoing gap likely reflects deeper structural barriers, such as restrictive gender norms, limited reproductive agency, and gaps in service delivery, which continue to hinder many women from turning their reproductive intentions into actual contraceptive use. Moreover, the fact that unmet need is evenly distributed between spacing and limiting births may indicate a mismatch between women's

fertility preferences and the availability, accessibility, or acceptability of contraceptives and their method choice.

Household power structures significantly influence women's contraceptive method use and choice (Dhak *et al.*, 2020; Sarwer *et al.*, 2024). In many families, traditional gender norms place decision-making authority solely in the hands of men, restricting women's control over their reproductive and sexual health and rights. However, research indicates that women with greater autonomy in household decision-making are more likely to choose modern contraception (Dhak *et al.*, 2020; Khatun *et al.*, 2023; Kumari *et al.*, 2024; Lahole *et al.*, 2024; Sarwer *et al.*, 2024). Based on data from the Bangladesh Demographic and Health Surveys (BDHS), previous studies suggest that women with higher decision-making power are more inclined to adopt effective FP methods, underscoring the role of women's empowerment in reproductive behavior (Rahman *et al.*, 2014; Sarwer *et al.*, 2024).

Education is a well-recognized key determinant of contraceptive use and method choice among women in LMICs, including Bangladesh. Highly educated women are generally more informed about contraceptive options and feel more confident in making reproductive decisions (Lahole *et al.*, 2024; Rahman *et al.*, 2014; Sarwer *et al.*, 2024). Educated women are also more likely to seek medical healthcare services, engage in frequent discussions about FP with their husbands and neighbors, and adopt more effective, that is, modern contraceptive methods to achieve their desired family size (Dhak *et al.*, 2020; Kamal & Islam, 2012; Khatun *et al.*, 2023; Kumari *et al.*, 2024; Lahole *et al.*, 2024; Sarwer *et al.*, 2024). Therefore, investing in female education is a strategic approach to enhancing reproductive autonomy and advancing gender equality in Bangladesh, as well as in other developing countries.

Despite overall progress in contraceptive use, significant disparities still exist between places of residence. Urban women generally have better access to healthcare facilities, greater exposure to mass media, and higher levels of education, all of which contribute to increased contraceptive use. In contrast, women residing in rural areas face substantial challenges, including limited access to medical facilities, lower literacy rates, and restrictive cultural norms that hinder their ability to make independent reproductive choices (Dhak *et al.*, 2020; Kamal & Islam, 2012; Lahole *et al.*, 2024; Sarwer *et al.*, 2024). Bridging these gaps requires targeted policies and programs based on the findings from studies using the most recent data and appropriate statistical analysis that focus on underprivileged women, ensuring equal access to contraceptive services across different socioeconomic strata.

Women's bargaining power within households plays an important role in shaping contraceptive method use and choice in Bangladesh (Kamal & Islam, 2012; Rahman *et al.*, 2014; Sarwer *et al.*, 2024) and other LMICs. Factors such as decision-making autonomy, education, mass media exposure, and regional disparities significantly influence women's ability to make informed reproductive and sexual health decisions (Kamal & Islam, 2012; Rahman *et al.*, 2014; Sarwer *et al.*, 2024). Strengthening women's empowerment can lead to increased use of more effective contraceptive methods, improved maternal health outcomes, and overall progress toward national and global development objectives.

However, the effects of women's household decision-making autonomy—and particularly the impact of their sexual rights—on contraceptive method choice have not been thoroughly explored in Bangladesh. Specifically, the link between women's sexual rights—captured through their attitudes toward the acceptability of wife-beating when a wife refuses sex—remains largely overlooked in the existing body of research. We argue that such an attitude serves as a direct indicator of a woman's sexual autonomy and overall empowerment, making it a critical variable for understanding how power dynamics influence reproductive choices. This study aims to rigorously examine how women's household bargaining power, specifically decision-making autonomy and sexual rights, shapes contraceptive method choices among women in Bangladesh. A key area of interest lies in exploring the link between attitudes toward gender-based violence, specifically, the perception that a husband is justified in hitting his wife for refusing sex, and its relation to contraceptive decision-making.

The study aims to contribute by highlighting how power relations and women's sexual rights influence contraceptive method choices in Bangladesh, offering new insights for improving reproductive health policies and gender-equitable FP programs. The structure of the study is organized in a standard scientific manner. It begins with an abstract, followed by the introduction, then details the data and methods (including data sources, variables, and statistical analysis), presents the results, proceeds with a discussion (interpretation of findings and comparison with prior studies), outlines the strengths and limitations, and concludes with policy implications, followed by references.

1.1. Theories and the conceptual framework

1.1.1. Theories

Women's decision-making on contraceptive method use and choice is a multilevel process that is influenced by individual cognition, relationships with other people,

community settings, and health-system conditions. Psychological theories of decision-making—the most prominent being the Theory of Planned Behavior (TPB)—suggest that the decision to use contraceptives can be determined by individual attitudes, social expectations, and the perceived capability of an individual to act upon these expectations. TPB has been extensively used in reproductive health behavior research, particularly in studies on contraceptive use and persistence (Ajzen, 1991).

In addition to TPB, Bulatao (1989) and other similar theories argue that contraceptive method choice as a consequence of: (i) Contraceptive objectives (desired family size, spacing), (ii) competence and knowledge (skills and information to use methods), (iii) evaluation (attitudes toward safety, side effects, acceptability), and (iv) access (availability, cost, and service quality). These dimensions help explain why, among users, specific approaches such as traditional and modern methods (pills, injectables, sterilization, condoms, intrauterine device [IUD]) are more or less popular. This framework has been applied and generalized in empirical studies across many LMICs, including Bangladesh, to demonstrate how both demand-side (knowledge, preferences, parity) and supply-side (method availability, provider bias) variables influence method mix (Bulatao, 1989).

In conservative societies, such as Bangladesh, the attitudes of men and the decision-making patterns of couples often affect women's contraceptive practices, which is a contribution of gender and power theories. Research consistently indicates that communication between spouses and the locus of decision-making (woman, husband, joint) are strong predictors of contraceptive adoption and method choice. The use of contraception is also linked with women's empowerment (autonomy in decision-making, social independence, attitudes toward gender-based violence), although this correlation may depend on the specific domain of empowerment and the type of method used. Therefore, gendered power relations should be considered alongside psychological and access-related factors to comprehensively address contraceptive patterns (Ajzen, 1991; Kundu *et al.*, 2022).

Finally, the social ecological model (SEM) offers a convenient organizing taxonomy: (i) Individual (age, education, parity, fertility desires, knowledge, attitudes), (ii) interpersonal (husband/partner influence, family, social norms), (iii) community (urban/rural setting, local service mix, cultural norms), and (iv) system/policy (FP program outreach, commodity supply, service quality). SEM emphasizes cross-level interactions (e.g., how access modulates the impact of attitudes), which is critical for both explaining causes and informing policy-making (Kundu *et al.*, 2022).

1.1.2. Conceptual framework

The conceptual framework of this study combines TPB, Bulatao's method-choice dimensions, women's empowerment constructs, and the SEM:

- (i) Individual: Age, education, parity, fertility preference, knowledge regarding contraceptive methods, and attitudes (perceived benefits/harms) influence intention to use contraception and preference for a specific method (Ajzen, 1991).
- (ii) Interpersonal variables: Partner/husband attitudes, communication between spouses, and household decision-making, and family influence directly affect both the use and choice of method (male or female), and mediate the impact of individual intention (Ajzen, 1991; Kundu *et al.*, 2022).
- (iii) Community and service environment: Geographic location, place of residence (urban or rural), method availability within the community, and prevailing community behavioral patterns influence access and the feasibility of preferred methods. These factors also impact perceived behavioral control (TPB) and method evaluation (Ajzen, 1991; Bulatao, 1989). For example, programmatic factors such as the strength of FP programs, supply chains for contraceptive commodities, and the quality of outreach and counseling services can influence method choice through changes in access, cost, and quality. System-level factors can enhance or dampen the effects of the other domains (NIPORT *et al.*, 2024).

2. Data and methods

2.1. Data source and sample

This study used data from the most recent 2022 BDHS. The survey was conducted by NIPORT, a government organization in Bangladesh. After excluding one rural cluster from the Chittagong division, data collection was undertaken in 674 clusters. A total of 30,358 women were enumerated across 30,300 households in the selected clusters. Of these, 30,078 ever-married women from both rural and urban areas were deemed eligible for interview, representing 99% of those listed. Out of these, 20,217 married women were qualified to provide full information, and ultimately 18,245 were successfully interviewed. The data collection followed a two-stage cluster sampling design. In the first stage, 675 primary sampling units were chosen using probability proportional to size, comprising 237 urban and 438 rural locations. The survey collected extensive information on topics such as fertility, contraceptive method mix, contraceptive use, maternal and child healthcare, nutritional status of mothers and children, and various socio-demographic factors. The 2022

BDHS employed the Integrated Multi-Purpose Sampling Master Sample to collect data from respondents in the selected enumeration areas, covering the entire country. A comprehensive description of the survey is documented in other sources (NIPORT *et al.*, 2024). After removing cases with missing information, a final sample of 17,783 married women aged 15–49 was included in the analysis. It is important to note that in Bangladesh, sexual relations and childbearing outside of marriage are culturally stigmatized, socially unacceptable, and legally prohibited. For this reason, our study was restricted to married women only. A summary of the sampling procedure is presented in Figure 1.

2.2. Description of variables

2.2.1. Outcome variable

The outcome of interest of this study was the choice of contraceptive method. The survey documented a wide range of FP methods, including oral pills, IUDs, injections, diaphragms, male condoms, female sterilization, male sterilization, implants, and emergency contraception. These methods are collectively classified as modern methods. In contrast, methods such as periodic abstinence, withdrawal, and lactational amenorrhea are categorized as traditional methods. Consequently, contraceptive method choice was classified into three categories: Non-use, traditional methods, and modern methods. The breakdown of contraceptive method mix and use rate is illustrated in Figure 2.

2.2.2. Explanatory variables

This study mainly focuses on examining the effect of women's empowerment in household decision-making and their sexual rights on the choice of contraceptive methods: Traditional method, modern method, and non-use (reference category). To fulfill the objectives of the study and based on data availability, three indicators of women's empowerment were considered: FP decision-making, household decision-making autonomy, and sexual rights of women—specifically, a woman's right to refuse sex with her husband. The third indicator is the main focus of this study, as it directly reflects women's reproductive and sexual rights and overall empowerment. The dataset included five response options for FP decision-making: Respondent alone, husband/partner alone, joint decision by both spouses, someone else, and other. The last two categories were merged and labeled as "others."

The survey collected data on five indicators related to the "justification of wife-beating." This study specifically focused on the indicator assessing whether "beating is justified if a wife refuses to have sex with her husband." This

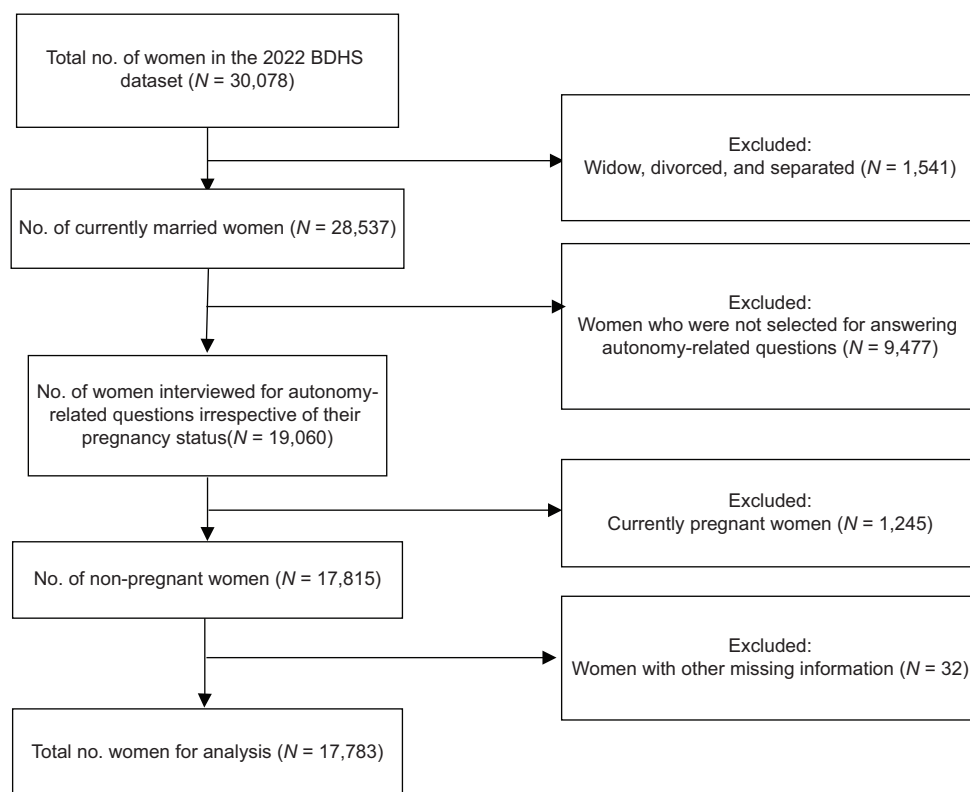


Figure 1. Flowchart of the sample selection process from the 2022 BDHS
Abbreviation: BDHS: Bangladesh demographic and health survey.

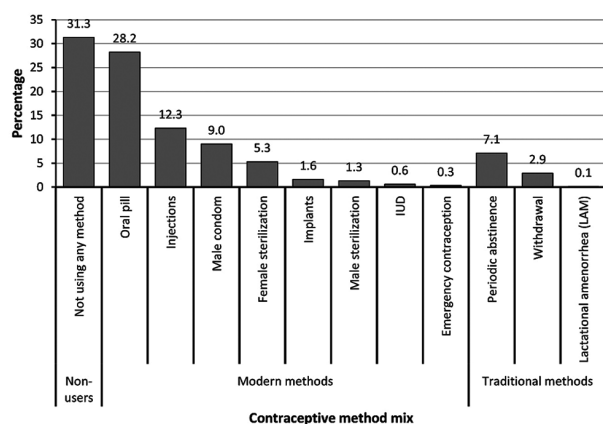


Figure 2. Breakdown of contraceptive method mix used by women in Bangladesh

Source: 2022 Bangladesh Demographic and Health Survey data.
Abbreviation: IUD: Intrauterine device.

variable was selected because it is directly linked to women's sexual autonomy, making it a critical factor in examining its association with contraceptive use and method choice. Furthermore, responses to the other four indicators showed nearly 98% agreement, indicating no substantial variation or influence on contraceptive behavior. Based on

this, the other indicators of “justification of wife-beating” were excluded from the analysis.

Women's household decision-making autonomy was assessed using five indicators: (i) Control over the respondent's earnings, (ii) decisions regarding the respondent's healthcare, (iii) authority over major household purchases, (iv) decision-making regarding visits to family or relatives, and (v) control over the use of the husband's earnings. Each indicator offered five to six response options: Respondent alone, husband/partner alone, joint decision by both spouses, respondent with another person, someone else, and other. To quantify autonomy, a weight of 2 was assigned for independent decision-making by the respondent, 1 for joint decisions, and 0 for all other cases. The reliability of these assigned weights was evaluated using Cronbach's alpha, which yielded a score of 0.703, demonstrating strong reliability and consistency. The estimated median score was 4.0, with composite scores categorized into two groups: Values above 4.0 were classified as “high” autonomy for women, while those at or below 4.0 were labeled as “low” autonomy.

Aligned with earlier studies conducted in Bangladesh and other LMICs, and a comprehensive literature review (Arends-Kuenning, 2001; Hossain *et al.*, 2018; Khatun *et*

al., 2023; Kumari *et al.*, 2024; Kundu *et al.*, 2022; Sarwer *et al.*, 2024), the other explanatory variables encompass socio-demographic variables such as women's age group, number of living and deceased children, births in the past five years, education levels of both women and their husbands, women's participation in paid jobs irrespective of formal and informal sectors, household wealth index, religious affiliation, desire for more children, visits from government FP workers (FPWs) to the respondents, and access to mass media.

The 2022 BDHS dataset lacks direct economic indicators such as individual income or consumption expenditure. To overcome this limitation, Demographic and Health Surveys (DHS) generally evaluate economic status using the household wealth index, a composite measure widely used in demographic and health research. This index was developed by the BDHS based on various socioeconomic factors, including household facilities, household environment, and ownership of consumer goods. The details of the computation procedure for the household wealth index are provided in the 2022 BDHS report (NIPORT *et al.*, 2024). In addition, four community-level variables were included in the analysis: Residence, administrative regions, socioeconomic status, and women's education. Consistent with previous studies (Lahole *et al.*, 2024), data regarding place of residence and administrative regions were directly sourced from the BDHS dataset, while other community-level factors were derived from aggregated cluster-level data. The BDHS directly provided the composite wealth index score for each household in the raw dataset, taking into account the respondents' place of residence. To measure community-level wealth status, we followed a methodology comparable to that used for household-level wealth measures or indices (Dias & de Oliveira, 2015). Based on these cluster-specific scores, we computed a national median score. Socioeconomic status was then classified as high if the composite score was equal to or above the national median, and as low if it was below the national median.

Similarly, the educational status of women in every neighborhood (cluster) was estimated using data on individual educational attainment of women living in the respective clusters. The 2022 BDHS data provided educational attainment in completed years in continuous form. Based on this data, we calculated a median educational score for each cluster. Clusters with a median score greater than the national median were classified as having a high level of education, whereas clusters with a median score equal to or less than the national median were labeled as having a low level of women's education.

Table 1 presents the comprehensive operational definitions and measurements of the individual,

demographic, socioeconomic, and community-level factors included in this study for analysis. Before conducting multivariable analysis, the variance inflation factor (VIF) was used to assess multicollinearity. Due to the existence of multicollinearity, we excluded the variable, namely, "children ever born to per woman," from the analysis (the estimated VIF was 5.67). After this, the highest VIF value was recorded as 2.21, indicating that multicollinearity was not a concern in the analysis of this study.

2.3. Statistical analysis

This study employed simple cross-tabulation, bivariate, and multivariate statistical techniques. The association between the independent variables and types of contraceptive method choice—non-use, traditional method, and modern method—was assessed using χ^2 tests. Given the hierarchical structure of the data—where women were nested within households, and households were nested within clusters—the influence of both individual-level (including demographic, household, and socioeconomic factors) and community-level variables on the three categories of contraceptive method choice (non-use [reference category], traditional method, and modern method) was assessed using multilevel multinomial logistic regression (MLMLR) analysis.

An initial assessment of the MLMLR indicated that household-level factors accounted for a negligible proportion of the total variance. In a separate analysis (not shown in the table), we observed that a significant majority of households (71%) included only one eligible woman. As a result, applying a three-level multinomial logistic regression would primarily capture variation at the individual or household level rather than at the cluster level. To address this limitation, we opted for a two-level MLMLR approach. The application of MLMLR was considered more appropriate, as women from households with similar characteristics may have varying choices of contraceptive methods depending on the characteristics of their surrounding community.

It is notable that, despite its advantages, MLMLR has several limitations. It relies on the assumption of the independence of irrelevant alternatives (IIA), which may not hold when closely related outcome choices are involved. Additionally, the model can be computationally demanding and complex, especially when it includes numerous outcome categories or levels of random effects, which may lead to convergence and interpretability issues. There is also the challenge of correctly specifying the model to prevent biased estimates, as well as the issue of limited or incomplete cluster-level data, which may hinder the analysis of contextual effects.

Table 1. Operational definitions of individual and socio-demographic factors and percentage/mean ($\pm$ SD) distribution of the respondents ($n=17,783$)

Covariates	Definition	Measurement scale and coding	<i>n</i>	Percentage/mean ($\pm$ SD)
Individual and socio-demographic factors				
Present age	Present age of the women at the time of the survey (in completed years)	Ordinal	-	32.2 $\pm$ 8.80
	1=15–24	4,099	23.1	
	2=25–34	6,260	35.2	
	3=35–49	7,424	41.7	
Children ever born	Mean no. of children ever born per woman	Ordinal and continuous	17,783	2.23 $\pm$ 1.38
Living children	Number of living children per woman at the time of the survey	Ordinal and continuous	17,783	2.09 $\pm$ 1.25
Children died	Number of deceased children at the time of the survey	Ordinal and continuous	17,783	0.14 $\pm$ 1.25
Births in the past five years	Total number of births in the past five years	Ordinal and continuous	17,783	0.46 $\pm$ 0.61
Women's education	A woman's level of education	Ordinal	-	-
	0=No education	2,373	13.3	
	1=Primary	4,681	26.3	
	2=Secondary	8,140	45.8	
Husband's education	3=Higher	2,589	14.6	
	Husband's level of education	Ordinal	-	-
	0=No education	3,851	21.7	
	1=Primary	4,989	28.1	
Engaged in earning cash	2=Secondary	5,669	31.9	
	3=Higher	3,274	18.4	
	Whether the women were engaged in cash earning at the time of the survey	Binary	-	-
	0=No	11,918	67.0	
Wealth index	1=Yes	5,865	33.0	
	Household wealth index	Ordinal	-	-
	1=Poorest	3,123	17.6	
	2=Poorer	3,508	19.7	
Religion	3=Middle	3,534	19.9	
	4=Richer	3,691	20.8	
	5=Richest	3,927	22.1	
	Religious affiliation	Nominal	-	-
Desire for more children	1=Islam	15,912	89.5	
	2=Others	1,871	10.5	
	Whether the women expressed a desire for more children	Binary	-	-
	0=No	12,050	67.8	
Visited by FPHW	1=Yes	5,733	32.2	
	Whether the respondent was visited by a family planning worker	Binary	-	-
	0=No	14,538	81.8	
	1=Yes	3,245	18.2	
Access to media	Whether the respondent had access to newspapers, radio, or TV	Binary	-	-
	0=No	7,298	41.0	
	1=Yes	10,485	59.0	

(Cont'd...)

Table 1. (Continued)

Covariates	Definition	Measurement scale and coding	<i>n</i>	Percentage/mean (±SD)
Women's autonomy-related factors				
Family planning decision-maker	Family planning decision-maker	Nominal	-	-
	1=Respondent alone	2,037	11.5	
	2=Husband alone	1,572	8.8	
	3=Husband–wife jointly	13,951	78.5	
	4=Others	223	1.3	
Household decision-making autonomy	Power bargaining of the respondents in the household decision-making	Ordinal	-	-
	1=Low	12,078	67.9	
	2=High	5,705	32.1	
Right to refuse sex	Whether the respondents have the right to refuse sex with their husbands	Binary	-	-
	0=No	17,238	96.9	
	1=Yes	545	3.1	
Community-level variables				
Place of residence	The place of residence where the respondent was living at the time of the survey	Nominal	-	-
	1=Urban	6,234	35.1	
	2=Rural	11,549	64.9	
Administrative regions	The place of the administrative region where the respondent was living at the time of the survey	Nominal	-	-
	1=Barishal	1,913	10.8	
	2=Chattogram	2,610	14.7	
	3=Dhaka	2,698	15.2	
	4=Khulna	2,324	13.1	
	5=Mymensingh	1,915	10.8	
	6=Rajshahi	2,319	13.0	
	7=Rangpur	2,169	12.2	
	8=Sylhet	1,835	10.3	
Community-level women's education	Community-level women's education derived from women's individual raw dataset	Nominal	-	-
	1=Low	10,865	60.1	
	2=High	6,918	39.9	
Community-level wealth	Community-level wealth derived from women's individual raw dataset	Nominal	-	-
	1=Low	11,061	62.2	
	2=High	6,722	37.8	
Total number of women	Total number of sampled women	<i>N</i>	17,783	100.0

Source: Bangladesh Demographic and Health Survey 2022.

Abbreviations: SD: Standard deviation; TV: Television.

Notwithstanding its limitations, MLMLR is an adequate and more suitable statistical technique for examining trichotomous outcomes of interest, such as contraceptive method choice (i.e., non-use [reference category], traditional, and modern methods). It accounts for the hierarchical nature of the data while allowing for the simultaneous comparison of several categorical outcomes. This makes MLMLR particularly relevant and effective in reproductive

health research, where both individual-level and cluster-level determinants influence contraceptive behavior.

2.3.1. Model-building process

In this study, the model-fitting procedure involves four stages: (i) The initial stage involved constructing a null model (without explanatory variables) to examine the baseline variation across clusters. (ii) The second stage

included only individual-, socio-demographic-, and autonomy-related factors (Model I). (iii) In the third stage, we included only community-level variables (Model II). (iv) In the final stage (Model III), all relevant individual, demographic, household socioeconomic, and women's autonomy-related factors, as well as community-level explanatory variables that may influence the choice of contraceptive methods, were included to develop a contextual model.

2.3.2. Random-effects analysis (Measures of variance)

Random variation in the choice of traditional or modern FP methods, compared to non-use, across clusters was determined using the intra-class correlation coefficient (ICC), proportional change in variance (PCV), and median odds ratio (MOR). In this context, the ICC reflects the proportion of overall variation in the use of traditional and modern methods that is attributable to differences between clusters. The PCV, which represents the percentage of variance explained in a multilevel model, was used to assess the extent to which variation in FP method choice could be attributed to individual- or community-level factors. The MOR was estimated to quantify the heterogeneity in the odds of contraceptive method preference among women across clusters.

The results of the MLMLR analyses are presented using relative risk ratios (RRRs). To present the main results of the four MLMLR models clearly, the 95% confidence intervals (CIs) were not included in the table but are described in the findings. The level of significance was set at $p < 0.10$. Estimates were made nationally representative by applying the individual weighting factor. Graphical presentations were created using MS Excel, and data were analyzed using the Statistical Package for the Social Science v25 (IBM, United States of America [USA]) and Stata 15 (StataCorp, USA).

2.4. Ethical consideration

This study used the nationally representative 2022 BDHS data set, which is publicly available free of charge from the DHS Program website (https://dhsprogram.com/data/dataset_admin/). The DHS program provides standardized recode files in multiple formats for public use. All DHS surveys undergo ethical review by the Institutional Review Board of the International Classification of Functioning, Disability and Health, United States. In addition, the BDHS protocol received ethical approval from the Bangladesh Medical Research Council, under the Ministry of Health and Family Welfare, Bangladesh. As the DHS datasets are de-identified and publicly available for research purposes, this study did not require additional ethical approval.

3. Results

3.1. Characteristics of the sample women

Table 1 presents the percentage distribution of the respondents by their background characteristics. The average (mean $\pm$ standard deviation) age of the women was 32.2 ± 8.8 years. The mean number of children ever born and currently living children per woman was 2.23 ± 1.38 and 2.09 ± 1.25 , respectively. Among the women, 14.4% had attained higher education, while the corresponding percentage for their husbands was 18.4%. One-third of the women were engaged in cash-earning activities, and 37.3% belonged to economically disadvantaged households.

The respondents were predominantly Muslim, and about one-third expressed a desire to have more children. Less than one-fifth of the respondents had been visited by government FPWs. More than three-quarters participated in joint decision-making regarding FP, whereas only 11.5% made these decisions independently. Of the respondents, two-fifths had no access to any media, such as newspapers, radio, or television. Less than one-third had a high level of autonomy in household decision-making, and only 3.1% believed that they had the right to refuse sexual relations with their husband. Over one-third (35.1%) of the women resided in urban areas, and 15.2% were from the Dhaka division. Nearly two-fifths lived in communities where women had higher education, and 37.8% were from communities with high wealth levels.

3.2. Breakdown of the contraceptive method mix

Figure 2 presents a detailed breakdown of the contraceptive method mix and corresponding usage rates. As illustrated in the figure, the oral pill emerged as the most commonly used modern contraceptive method among women in Bangladesh, followed by male condoms, female sterilization, implants, male sterilization, IUDs, and emergency contraception, in that order. Among traditional methods, periodic abstinence was the most preferred, followed by withdrawal and the lactational amenorrhea method, respectively. The prevalence rates for each method are also indicated in the figure.

3.3. Differentials in contraceptive method choice

Table 2 presents the variations in contraceptive method choice among women based on their individual, socio-demographic, and community-level factors. The findings indicate that one in 10 women used traditional contraceptive methods, while nearly two-thirds (58.6%) were currently using modern contraceptive methods. In contrast, 31.1% of the women were non-users of any contraceptive method. Overall, 68.7% of the women were contraceptive users.

Table 2. Distribution of women aged 15–49 years by contraceptive use status and method choice by individual, socio-demographic, and community-level factors ($n=17,783$)

Covariates	Percentage of women			χ^2 -test <i>p</i> -value
	Non-users	Using traditional methods	Using modern methods	
Individual, demographic, and socioeconomic factors				
Present age				
15–24	33.3	6.7	59.9	<0.001
25–34	27.4	7.5	65.1	
35–49	33.4	14.2	52.4	
Women's education				
No education	36.7	11.5	51.7	<0.001
Primary	28.2	10.1	61.6	
Secondary	31.0	9.2	59.8	
Higher	32.8	11.5	55.7	
Husband's education				
No education	31.7	10.9	57.4	<0.001
Primary	28.8	8.8	62.4	
Secondary	33.3	9.5	57.2	
Higher	31.2	12.2	56.7	
Earn cash				
No	33.8	9.5	56.7	<0.001
Yes	26.2	11.3	62.4	
Wealth index				
Poorest	26.9	8.4	64.7	<0.001
Poorer	30.6	9.4	60.0	
Middle	30.6	10.1	59.3	
Richer	31.9	10.2	57.9	
Richest	35.4	12.0	52.6	
Religion				
Islam	32.1	9.7	58.2	<0.001
Others	24.1	13.5	62.5	
Desire for more children				
No	25.5	11.5	63.1	<0.001
Yes	43.5	7.2	49.3	
Visited by family planning workers				
No	33.7	10.6	55.6	<0.001
Yes	20.3	7.6	72.0	
Family planning decision maker				
Respondent alone	32.4	7.4	60.3	<0.001
Husband alone	31.9	10.6	57.5	
Husband-wife jointly	30.4	10.6	59.0	
Others	73.5	0.4	26.0	

(Cont'd...)

Table 2. (Continued)

Covariates	Percentage of women			χ^2 -test p -value
	Non-users	Using traditional methods	Using modern methods	
Access to media				
No	34.6	9.7	55.8	<0.001
Yes	29.0	10.4	60.6	
Women's autonomy-related factors				
Family planning decision-maker				
Respondent alone	32.4	7.4	60.3	<0.001
Husband alone	31.9	10.6	57.5	
Husband-wife jointly	30.4	10.6	59.0	
Others	73.5	0.4	26.0	
Women's household decision-making autonomy				
Low	35.8	9.7	53.5	<0.001
High	30.3	11.0	58.7	
Wife has the right to refuse sex with their husbands				
No	38.0	9.0	53.0	<0.001
Yes	31.1	10.1	58.7	
Community-level factors				
Place of residence				
Urban	28.7	11.6	59.7	<0.001
Rural	32.7	9.3	58.0	
Administrative regions				
Barishal	30.6	11.9	57.4	<0.001
Chattogram	36.3	9.9	53.8	
Dhaka	33.2	10.2	56.6	
Khulna	29.0	11.1	59.9	
Mymensingh	28.9	7.8	63.2	
Rajshahi	26.2	10.0	63.7	
Rangpur	25.4	10.4	64.2	
Sylhet	40.8	9.2	50.1	
Women's community-level education				
Low	34.3	11.5	54.2	<0.001
High	26.1	9.8	64.1	
Community-level wealth				
Low	31.1	9.3	59.6	<0.001
High	32.3	12.3	55.4	
Total	31.3	10.1	58.6	-

Source: Bangladesh Demographic and Health Survey 2022.

All variables included in the analysis showed a statistically significant association ($p<0.001$) with contraceptive method choice. The use rate of modern contraceptive methods was significantly higher among

women aged 25–34 years, whereas the highest prevalence of traditional method use was observed among older women aged 35–49 years. The prevalence of modern contraceptive use was also significantly higher among women with primary education, those whose husbands had primary education, women engaged in earning cash at the time of the survey, and those from the poorest households.

Additionally, non-Muslim women, those who expressed no desire for further childbearing, women who had been visited by FPWs, and those who independently made decisions regarding contraceptive use had higher rates of modern contraceptive use. Access to mass media, a high level of autonomy in household decision-making, and the belief that a wife has the right to refuse sexual intercourse with her husband were also positively associated with modern contraceptive practices. Furthermore, the adoption of modern contraceptive methods was more widespread among urban residents, women from communities with higher levels of female education, and those from communities with lower wealth levels.

Furthermore, women with no schooling and those with advanced education were more likely to rely on traditional contraceptive methods. Use of traditional methods was also more common among women whose partners were highly educated, those engaged in earning cash, the wealthiest women, non-Muslim women, and those who did not express a desire for additional children. Additionally, women who had not been visited by FPWs and those with access to mass media showed a higher tendency to use traditional methods. The use of traditional contraceptive methods was also more prevalent among women with greater autonomy in household decision-making, urban residents, women from the Barishal division, those from communities with low levels of female education, and those residing in more affluent communities.

3.4. Model fit of multilevel analysis

The random effects and model fitting estimates from the MLMLR analyses are displayed in Table 3. The model's goodness-of-fit was evaluated using the Akaike information criterion (AIC), Bayesian information criterion (BIC), and log-likelihood estimates. Lower values of AIC and BIC, along with higher values of log-likelihood, indicate a better-fitting model. A detailed examination of the estimates (not shown in the table) suggests that Model III provides the best fit for this study, as it incorporates individual, demographic, socioeconomic, and community-level factors. Notably, the estimated BIC values for model I and model III are almost identical, suggesting that the addition of community-level variables contributes little improvement. However, Model III offers a marginally

better fit to the data than Model I, even after accounting for the number of estimated parameters.

3.4.1. Empowerment-related factors associated with use of specific contraceptive methods

The MLMLR analysis results presented in Table 3 reveal that the prevalence of modern FP methods was notably higher in the women with greater household decision-making power (RRR: 1.23; 95% CI: 1.06–1.42; $p < 0.001$) compared to those with low autonomy, relative to non-users. While women with higher autonomy also showed a higher tendency to choose traditional methods compared to their less autonomous counterparts (relative to non-users), this association was found to be comparatively weaker (RRR: 1.17; 95% CI: 1.00–1.35; $p < 0.10$). Joint decision-making between spouses regarding FP was significantly and positively associated with a preference for modern FP methods (RRR: 1.15, 95% CI: 1.01–1.28). In contrast, when the husband alone made decisions regarding FP, the likelihood of using traditional methods increased significantly (RRR: 1.68, 95% CI: 1.30–2.18; $p < 0.001$), relative to non-users. Furthermore, women who believed that a wife has the right to refuse sex with her husband were more likely to prefer either traditional (RRR: 1.20, 95% CI: 1.06–1.34) or modern contraceptive methods (RRR: 1.33, 95% CI: 1.10–1.57), compared to those who did not hold this belief, relative to non-users.

3.5. Individual, demographic, and socioeconomic factors associated with contraceptive method choice

Table 3 shows that women aged 35–49 were significantly less likely to adopt any contraceptive method than those aged 15–24 years, relative to non-users. Additionally, a higher number of living children was positively associated with the use of either traditional or modern methods. Women who had experienced child mortality tended to use modern contraceptives less, compared to non-users; however, this factor was not significantly associated with the use of traditional methods. Recent childbirth was positively related to the use of either traditional or modern contraceptive methods relative to non-use.

Women's level of education showed a significant and positive linear association with contraceptive method choice. Women with higher education were 1.79 times more likely to choose traditional methods and 1.68 times more likely to prefer modern FP methods than those with no formal education, relative to non-users. Similarly, women whose husbands had attained higher levels of education were also more likely to use either traditional or modern contraceptive methods than those whose husbands had no formal education, relative to non-users.

Table 3. Results of multilevel multinomial logistic regression analysis of choosing traditional or modern contraceptive methods over non-use among women in Bangladesh

Covariates	Null model		Model I		Model II		Model III	
	Traditional versus non-use	Modern versus non-use	Traditional versus non-use	Modern versus non-use	Traditional versus non-use	Modern versus non-use	Traditional versus non-use	Modern versus non-use
Individual, demographic, and socioeconomic-level factors								
Fixed-effects intercept	−1.09	0.67	−2.23	0.33	−0.67	0.79	−1.77	0.55
Present age (in years)								
15–24 (ref)	-	-	-	-	-	-	-	-
25–34	-	-	0.73***	0.67***	-	-	0.72***	0.67***
35–49	-	-	0.80*	0.35***	-	-	0.79*	0.34***
Living children	-	-	-	1.31***	-	-	1.33***	1.34***
Children died	-	-	-	0.87***	-	-	0.95	0.88***
Births given in the past five years	-	-	-	1.48***	-	-	1.12*	1.49***
Women's level of education								
No education (ref)	-	-	-	-	-	-	-	-
Primary	-	-	1.48***	1.55***	-	-	1.46***	1.56***
Secondary	-	-	1.55***	1.62***	-	-	1.53***	1.63***
Higher	-	-	1.84***	1.69***	-	-	1.79***	1.68***
Husband's level of education								
No education (ref)	-	-	-	-	-	-	-	-
Primary	-	-	0.99	1.12*	-	-	0.98	1.13**
Secondary	-	-	1.02	1.02	-	-	1.01	1.03
Higher	-	-	1.38***	1.26***	-	-	1.33***	1.22**
Engaged in earning cash								
No (ref)	-	-	-	-	-	-	-	-
Yes	-	-	1.54***	1.53***	-	-	1.53***	1.49***
Household wealth index								
Poorest (ref:)	-	-	-	-	-	-	-	-
Poorer	-	-	0.95	0.78***	-	-	0.92	0.77***
Middle	-	-	0.97	0.74***	-	-	0.93	0.72***
Richer	-	-	0.88	0.67***	-	-	0.83 [‡]	0.65***
Richest	-	-	0.80*	0.53***	-	-	0.72**	0.50***
Religious affiliation								
Islam (ref)	-	-	-	-	-	-	-	-
Others	-	-	1.85***	1.50***	-	-	1.90***	1.56***
Desire for more children								
No (ref)	-	-	-	-	-	-	-	-
Yes	-	-	0.42***	0.33***	-	-	0.44***	0.34***
Visited by family planning workers								
No (ref)	-	-	-	-	-	-	-	-
Yes	-	-	1.15*	1.99***	-	-	1.14 [‡]	1.94***

(Cont'd...)

Table 3. (Continued)

Covariates	Null model		Model I		Model II		Model III	
	Traditional versus non-use	Modern versus non-use	Traditional versus non-use	Modern versus non-use	Traditional versus non-use	Modern versus non-use	Traditional versus non-use	Modern versus non-use
Access to mass media								
No (ref)	-	-	-	-	-	-	-	-
Yes	-	-	1.24***	1.43***	-	-	1.21***	1.34***
Women's autonomy-related factors								
Family planning decision-maker								
Respondent alone (ref)	-	-	-	-	-	-	-	-
Husband alone	-	-	1.69***	1.07	-	-	1.68***	1.08
Husband-wife jointly	-	-	1.65***	1.09 [‡]	-	-	1.66***	1.15***
Others	-	-	0.03***	0.23***	-	-	0.04***	0.24***
Household decision-making autonomy								
Low (ref)	-	-	-	-	-	-	-	-
High	-	-	1.18 [‡]	1.29***	-	-	1.17 [‡]	1.23***
Women have the right to refuse sex with their husbands								
No (ref)	-	-	-	-	-	-	-	-
Yes	-	-	1.22***	1.31***	-	-	1.20***	1.33***
Community-level factors								
Place of residence								
Urban (ref)	-	-	-	-	-	-	-	-
Rural	-	-	-	-	0.69***	0.82***	0.67***	0.68***
Administrative regions								
Barishal (ref)	-	-	-	-	-	-	-	-
Chattogram	-	-	-	-	0.69***	0.79**	0.65***	0.75**
Dhaka	-	-	-	-	0.75**	0.88	0.82 [‡]	1.04
Khulna	-	-	-	-	0.98	1.10	0.99	1.19
Mymensingh	-	-	-	-	0.73**	1.19*	0.70**	1.12*
Rajshahi	-	-	-	-	0.99	1.30**	1.03	1.43**
Rangpur	-	-	-	-	1.09	1.38***	1.04	1.38***
Sylhet	-	-	-	-	0.57***	0.65***	0.55***	0.64***
Community-level women's education								
Low (ref)	-	-	-	-	-	-	-	-
High	-	-	-	-	0.87 [‡]	1.23***	0.91	1.21***
Community-level wealth								
Low (ref)	-	-	-	-	-	-	-	-
High	-	-	-	-	1.12 [‡]	0.88	1.09	0.89

Note: [‡] $p < 0.10$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Abbreviation: ref: Reference.

Women's cash earnings also emerged as a significant influencing factor in contraceptive method use and choice. Women engaged in income-generating activities,

particularly those earning cash, were 1.53 times more likely to use traditional methods and 1.49 times more likely to use modern methods than those not involved in paid

jobs, relative to non-users. Interestingly, the household wealth index demonstrated a negative association with the adoption of modern contraceptive methods, indicating that an increase in wealth was linked to a decreased likelihood of choosing modern methods among women.

Religious affiliation played a notable role; Muslim women were significantly less likely to use both modern and traditional contraceptive methods compared to non-Muslim women. Additionally, women who expressed a desire to have more children were considerably less likely to use any contraceptive methods—traditional or modern—compared to those who did not, relative to non-users. There were positive relationships between FPWs' visits and the adoption of modern contraceptive methods, although the influence on the choice of traditional methods was somewhat weaker. Moreover, access to mass media was positively associated with the use and choice of traditional or modern FP methods.

3.6. Community-level factors and random effects associated with contraceptive method choice

This study incorporated four community-level factors. Among these, community-level wealth did not have any significant impact on the choice of FP methods after adjusting for other explanatory variables. Women residing in rural areas were less likely to use either traditional or modern FP methods compared to their urban counterparts, relative to non-users. Specifically, the odds of choosing traditional and modern methods were 33.0% and 32.0% lower, respectively, among rural women than their urban counterparts, relative to non-users.

The findings also highlight regional disparities in contraceptive method choices across different administrative regions. Women from the Rajshahi division had a significantly higher likelihood of choosing modern contraceptive methods compared to those from the Barishal division, while the lowest likelihood was observed among women from the Sylhet division, relative to non-users. In addition, compared to women in Rajshahi, those in Dhaka, Mymensingh, and Sylhet divisions were significantly less likely to use traditional methods, relative to non-users.

Furthermore, women living in communities with a high level of female education were significantly more likely to choose modern contraceptive methods than those from communities with a lower level of female education. However, this factor did not have a significant impact on the choice of traditional methods, relative to non-users.

Based on the random-effects analysis, the estimated ICC value from the null model (Table 4) indicates that 12.5% of the variability in contraceptive method choice

Table 4. Results of random effects from multilevel multinomial logistic regression analyses

Measures of random-effects	Null model	Model I	Model II	Model III
Cluster-level variance (standard error)	0.47 (0.02)	0.38 (0.02)	0.33 (0.02)	0.31 (0.02)
ICC (%)	12.50	10.40	9.10	8.60
PCV (%)	Ref.	19.10	29.80	34.40
MOR	1.56	1.43	1.37	1.34

Abbreviations: ICC: Intra-class correlation coefficient; MOR: Median odds ratio; PCV: Proportional change in variance; Ref: Reference.

among married women can be attributed to differences across clusters, reflecting heterogeneous individual and socioeconomic structures at the community level. Analysis of the PCV in the final model revealed that 34.4% of the variation in contraceptive method choice across communities was explained by the inclusion of individual, demographic, socioeconomic, and community-level factors. Furthermore, the MOR in the null model was estimated at 1.56, indicating heterogeneity in contraceptive method choice between clusters. This suggests that, all else being equal, the odds of using a contraceptive method were 1.56 times higher in clusters with a greater prevalence of contraceptive use compared to those with lower usage.

4. Discussion

This study examined the extent to which household decision-making power and sexual rights influence contraceptive method choices among Bangladeshi women, using the nationally representative 2022 BDHS data. The analysis included 17,783 married women. The results indicate that overall, 68.7% of these women were using contraception, with 10.1% relying on traditional methods and 58.6% using modern contraceptive methods. These findings show minimal variation from national estimates as reported in the 2022 BDHS report (NIPORT *et al.*, 2024), likely due to the sampling procedure used in this study. The slight differences can be attributed to the exclusion of women with missing information related to women's empowerment, currently pregnant women, and those with other missing information.

Our findings support Bulatao's theory (Bulatao, 1989) and the SEM, which suggest that women with greater household decision-making autonomy are more inclined to utilize modern or traditional contraceptive methods rather than forgo contraception entirely. This empowerment enables access to vital reproductive health information and supports informed FP decisions. Research indicates that such women are more likely to proactively consult healthcare providers and collaborate with their partners

in selecting suitable contraceptive options, thereby increasing uptake (Abita & Girma, 2022). Additionally, higher autonomy helps overcome socio-cultural barriers and dispel common misconceptions about contraception, allowing for a more informed assessment of benefits and better management of potential side effects (R. Ghosh *et al.*, 2021; Mutumba, 2022; Rahman *et al.*, 2014). Ultimately, the ability to make independent decisions contributes to improved reproductive health outcomes, as these women are more likely to adopt either modern or traditional methods compared to non-users.

Women empowered to refuse sexual intercourse with their husbands show a higher likelihood of choosing either modern or traditional FP methods compared to their less empowered counterparts. This ability reflects a higher degree of personal autonomy and empowerment within the marital relationship, which is strongly associated with improved reproductive health outcomes. More empowered women generally have better access to FP resources and information, and they are more confident in negotiating sexual and reproductive choices with their partners. This autonomy enables them to make informed decisions about contraception, including adopting modern or traditional methods to manage fertility and protect their reproductive and sexual health and rights. In contrast, women with lower levels of decision-making autonomy may experience difficulties in accessing and using contraceptives, resulting in higher rates of non-use. Recent studies emphasize that promoting women's control and agency over their sexual and reproductive choices is key to increasing contraceptive uptake and enhancing overall reproductive well-being (Abita & Girma, 2022; Ghosh *et al.*, 2021; Mutumba, 2022).

Most of our findings corroborate prior research conducted in Bangladesh (Khatun *et al.*, 2023; Kundu *et al.*, 2022; Sharif *et al.*, 2023) and other countries (Ghosh & Siddiqui, 2017; Kumari *et al.*, 2024; Lahole *et al.*, 2024; Teshale, 2022). The results indicate that women aged 35–49 were more likely to use traditional FP methods and less likely to prefer modern contraception compared to those aged 15–24. These findings are largely in line with studies from Bangladesh (Khatun *et al.*, 2023; Kundu *et al.*, 2022; Rana *et al.*, 2024; Sharif *et al.*, 2023), Ghana (Lahole *et al.*, 2024), Ethiopia (Hailegebreal *et al.*, 2023), Senegal (Zegeye *et al.*, 2021), Malawi (Forty *et al.*, 2021), India (Ghosh & Siddiqui, 2017), and Pakistan (Kumari *et al.*, 2024).

However, these findings contradict some earlier research (Tessema *et al.*, 2021; Yifru *et al.*, 2020), which found that older women were more likely to choose modern contraceptives than their younger counterparts. This discrepancy may be explained by the tendency of older women to prefer traditional contraceptive methods,

such as periodic abstinence, over modern alternatives. This preference is often shaped by long-standing practices, cultural traditions, and limited exposure to contemporary contraceptive options (Hossain *et al.*, 2018). Moreover, religious doctrines and cultural customs play a significant role in shaping contraceptive choices. In some communities, skepticism or hesitation toward modern contraceptive methods may lead older women to rely more on traditional practices (Hossain *et al.*, 2018). Other demographic factors examined in this study, including the number of living children, child mortality, and childbirths in the past five years, yielded findings consistent with earlier studies (Rana *et al.*, 2024; Sharif *et al.*, 2023). Women with more children or those who have recently given birth are more likely to opt for either modern or traditional methods of contraception to prevent further or closely spaced pregnancies, or to create a substantial interval between successive births. Conversely, women who have experienced child loss tend to be more hesitant to use contraception, often seeking to conceive again as a way to compensate for their loss. The emotional and psychological impact of losing a child can create a strong desire for another pregnancy, leading many women to avoid the use of any FP methods. This tendency is particularly evident in societies where having a certain number of children is highly valued. In addition, cultural and societal expectations place pressure on women to bear children to uphold family lineage, and the death of a child can further reinforce the urgency to conceive again, often influenced by family or community expectations.

Our study found a positive association between women's level of education and their likelihood of using either modern or traditional contraceptive methods compared to their non-user counterparts. Research from Bangladesh (Alam *et al.*, 2024; Hoq, 2020; Kundu *et al.*, 2022; Rana *et al.*, 2024; Sharif *et al.*, 2023), and other developing countries (Ali & Abrejo, 2017; MacQuarrie & Aziz, 2024; Naz *et al.*, 2024; Tumwizere *et al.*, 2024) has shown that women who have completed at least a secondary level of education are more likely to adopt modern contraception than those with no formal education. This trend may be explained by the fact that women with higher education levels have greater access to information about the benefits of contraception, particularly modern methods, through various media platforms. Moreover, they are more inclined toward preventive healthcare practices, including seeking FP services. Higher-educated women are likely to possess greater health literacy, enabling them to navigate the healthcare system efficiently, access appropriate services, and understand the guidance they receive regarding FP options.

Our findings, consistent with a study from Senegal (Zegeye *et al.*, 2021), suggest that women whose husbands

are more educated are more likely to prefer either modern or traditional contraceptive methods than to remain non-users. In addition, women whose husbands had some primary education were more likely to choose modern contraceptives, but not traditional ones. In contrast, a husband's secondary education did not have a significant effect on the choice of FP methods. Educated husbands tend to be better informed about reproductive health and FP, making them more likely to support contraceptive use. However, in some societies, husbands hold considerable influence over women's reproductive decisions. While some educated men advocate for FP, others may maintain conservative views that discourage contraception, resulting in variations in its use and choice among women.

The engagement of women in income-generation activities was found to be a critical element in the choice of FP methods. Findings show that the women who were involved in income-generating activities, compared to those who were not, were more likely to choose either modern or traditional methods. These findings are consistent with many previous studies conducted in Bangladesh (Huda *et al.*, 2017; Islam *et al.*, 2017; Islam *et al.*, 2016; Khatun *et al.*, 2023) and other LMICs (Alemu *et al.*, 2022). However, some other studies have found no meaningful relationship between women's working status and contraceptive use (Kundu *et al.*, 2022).

It is plausible that cash-earning women have greater financial autonomy, enabling them to make informed decisions about FP, including the use of modern contraceptive methods. Their economic independence empowers them to control the timing and number of children, which supports career advancement and work-life balance. Additionally, women with paid employment typically have increased opportunities to utilize health and FP services, allowing them to gather information and make informed choices. Exposure to modern ideas through media, workplaces, and social networks further increases their awareness of the benefits of contraceptive use, making them more likely to adopt any FP method suitable for them.

An important finding of this study is that household wealth is negatively associated with the choice of contraceptive methods. The use of any FP method decreases with an increase in the wealth index. Our findings do not align with some previous studies conducted in Bangladesh. For instance, using 2017–2018 BDHS data, Kundu *et al.* (2022) found no meaningful association between household wealth and the choice of any FP method. In contrast, a study from Senegal found a significant positive association between wealth and FP method use (Zegeye *et al.*, 2021).

The association between household wealth and contraceptive use varies across populations and social contexts. Higher education levels, cultural beliefs, and personal preferences often shape women's reproductive choices, favoring methods that align with their lifestyle or future fertility plans. Additionally, greater awareness of potential side effects may lead them to avoid certain options. Moreover, wealthier families may prefer larger family sizes due to socioeconomic or cultural factors, further reducing contraceptive use. Overall, this negative correlation stems from differences in access, beliefs, education, health concerns, and fertility preferences across socioeconomic groups.

In this study, we found that Muslim women and those who expressed a desire for additional children showed a significantly lower likelihood of using any form of contraception, whether modern or traditional, compared to non-users. These findings are also supported by the SEM theory and by other studies conducted in Bangladesh (Islam & Habib, 2024) and Afghanistan (Alomair *et al.*, 2020). In numerous Muslim communities, children are considered divine blessings, and the use of contraception may be viewed as obstructing God's will. In addition, some women consider birth control sinful, believing it hinders the acceptance of such divine gifts. Moreover, cultural traditions in certain Muslim societies emphasize the importance of large families. In Muslim countries such as Afghanistan, where child mortality rates are high or in areas impacted by conflict, having more children is often seen as essential for preserving family lineage and ensuring stability (Alomair *et al.*, 2020; Kamal & Islam, 2012).

Our findings indicate that visits from FPWs significantly enhance the likelihood of reproductive-aged women adopting both modern and traditional contraceptive methods. These results align with numerous previous studies conducted in Bangladesh (Hossain & Phillips, 1996; Kamal & Islam, 2012). In Bangladesh, visits by FPWs have been instrumental in enhancing contraceptive use among women. One study demonstrated that household outreach services significantly improved the continuity of contraceptive use, with the impact intensifying over time (Hossain & Phillips, 1996). Similarly, low contraceptive prevalence rates were found to be associated with infrequent contact with FPWs, especially in hard-to-reach areas (Kamal & Islam, 2012). Another study indicated that FPWs' visits reduce contraception-related expenses and potentially increase demand, with recent visits significantly influencing women's contraceptive behavior. These findings underscore the critical role of regular, targeted home visits in promoting both modern and traditional contraceptive methods among users rather than non-users (Arends-

Kuenning, 2001; Kamal & Islam, 2012). These findings also reflect the core principles of TPB.

Access to mass media is a powerful factor that encourages women to adopt FP methods (Abita & Girma, 2022; Ghosh *et al.*, 2021; Mutumba, 2022). Media platforms, such as radio, television, print media, and online outlets play a critical role in informing individuals about reproductive health by offering detailed explanations of various contraceptive options, including their benefits, usage, side effects, and effectiveness. This dissemination of accurate information helps dispel myths and reduce misconceptions about contraception. Moreover, mass media frequently present expert opinions, personal testimonials, and public service announcements that normalize FP-related discussions. These portrayals not only enhance awareness but also foster a positive perception of contraceptive practices, encouraging informed decision-making. Consequently, individuals are more inclined to choose either modern or traditional FP methods rather than forgo contraception, ultimately improving overall reproductive health outcomes. This finding also aligns with the SEM theory.

Joint decision-making between spouses plays a crucial role in shaping women's preferences for modern or traditional contraceptive methods. When couples engage in FP discussions, they tend to align their reproductive goals and make well-informed choices. This collaboration allows both partners to address concerns, share reliable information, and assess the benefits and potential side effects of various contraceptive options. Studies have shown that couples who decide jointly report greater satisfaction with their contraceptive choices and demonstrate more consistent use (Abita & Girma, 2022). Furthermore, effective communication between spouses helps dispel misconceptions and alleviate fears related to contraception, ultimately leading to increased use of either modern or traditional methods (Ghosh *et al.*, 2021; Kamal & Islam, 2012; Mutumba, 2022). This finding also echoes the theory of Bulatao and TPB. This cooperative approach not only empowers women by actively involving them in decision-making but also reinforces the couple's commitment to managing their reproductive health, resulting in improved overall FP outcomes.

Consistent with the SEM theory and numerous previous studies, our findings indicate that women from rural communities, compared to their urban counterparts, are less likely to prefer modern or traditional contraceptive methods relative to non-users (Ghosh & Siddiqui, 2017; Kundu *et al.*, 2022; Lahole *et al.*, 2024; Sharif *et al.*, 2023; Teshale, 2022). Rural women in Bangladesh are less likely to use any contraceptive methods than urban women

due to socioeconomic, cultural, and accessibility barriers. Moreover, limited healthcare access reduces exposure to FP services, as rural areas have fewer healthcare centers and infrequent visits from FPWs. Lower education levels among rural women compared to their urban counterparts also contribute to misinformation and fear of side effects, which discourage contraceptive use and limit method choice. Cultural and religious norms among rural populations often favor larger families and restrict discussions on reproductive health, further limiting the adoption of the FP method. Additionally, financial constraints make contraception a lower priority for rural households focused on daily survival.

The heterogeneous picture of contraceptive use and method choice across regions is well documented in previous studies from Bangladesh (Ghosh & Siddiqui, 2017; Kundu *et al.*, 2022; Sharif *et al.*, 2023) and aligns with the outcomes of our study. These findings suggest that the use of FP methods in Bangladesh varies significantly by region due to differences in healthcare accessibility, education, and cultural norms. Healthcare infrastructures, which play a key role, are not uniform across the administrative regions of the country. More urbanized and developed regions have better access to FP services, while rural and remote areas, such as the Chittagong Hill Tracts, face shortages of healthcare facilities and government FPWs, limiting contraceptive availability.

In addition, educational disparities across communities influence contraceptive use. Regions with higher literacy rates tend to have greater awareness of FP, leading to a stronger preference for modern contraceptive methods. In contrast, lower literacy rates in certain regions contribute to misconceptions and a reliance on traditional methods or non-use. Cultural and religious beliefs further shape contraceptive preferences; conservative regions may discourage the utilization of modern contraceptive methods, favoring traditional practices. Addressing these disparities requires region-specific strategies, expanded FPW outreach, and improved healthcare access to ensure equitable reproductive and sexual health services.

A key strength of this study is its use of the latest comprehensive and nationally representative survey data, providing sufficient statistical power to accurately assess the effects of explanatory variables. The application of sampling weights in the analysis further enhanced the reliability of the estimates and standard errors. Additionally, by examining contraceptive method choice at the individual, socioeconomic, and community levels, the study employed robust statistical techniques that effectively captured hierarchical or cluster-level influences on the outcomes. However, a notable limitation lies in

the reliance on cross-sectional data, which prevents the establishment of causal relationships between the outcome of interest and the explanatory variables. Moreover, since DHS data are self-reported, it is susceptible to recall bias. Another important limitation of this study is the use of the mixed-effects multinomial logit regression model, which is based on the IIA assumption. This assumption implies that the odds of choosing between any two contraceptive methods remain unaffected by the presence or absence of other alternatives. In reality, however, some methods may be more or less substitutable, potentially violating this assumption. In this analysis, the IIA assumption was not explicitly tested, and therefore, caution is warranted when interpreting the estimates. Future studies could explore extensions to models that relax this assumption, such as the nested logit or multinomial probit model. Despite this limitation, the MLMLR model offers a practical balance between analytical rigor and interpretability when working with large, complex survey datasets, such as the BDHS. Alternative models that relax the IIA assumption are often computationally intensive and less accessible in multilevel frameworks. Thus, the use of MLMLR remains a justified and effective choice for this analysis.

5. Conclusion

The results of this study indicate a very strong connection between women's empowerment, specifically their roles in household decision-making and their sexual agency, and their likelihood of using modern or traditional methods of contraception. Women who are able to make key decisions in their households and who have the agency to refuse sex with their husbands are significantly more likely to use contraceptives compared to women who lack such autonomy. These findings indicate that improving contraceptive access in Bangladesh should not rely solely on traditional service delivery mechanisms, but must also address the underlying power structures that contribute to reduced contraceptive use.

Drawing on a thorough literature review and established research, this study also considers other important explanatory factors that influence Bangladeshi women's contraceptive method choices. These factors include women's age group, number of living and deceased children, births within the past five years, women's and their husbands' educational attainment, women's employment status, household wealth index, religious affiliation, desire for more children, visits from government FPWs, and access to mass media.

Furthermore, women who are more financially independent are more likely to choose either traditional or modern contraceptive methods. Interestingly,

contraceptive use appears lower among women living in more affluent households. There are also marked regional variations in contraceptive use and preferences. To reduce regional disparities, policy implications highlight the need to expand government FPWs, improve healthcare access, and promote education and awareness. Improving contraceptive uptake, especially in rural and underserved areas, requires empowering women in household decision-making and sexual rights, removing cultural and religious barriers, and encouraging spousal involvement in FP decisions. Additionally, expanding media access can help dispel myths and increase awareness, thereby improving FP outcomes. To ensure equitable access to contraception across Bangladesh, tailored approaches that account for regional and socioeconomic disparities are essential. Future research and policy efforts should focus on dismantling socio-cultural barriers and implementing programs that strengthen women's agency, ensuring that every woman has both the resources and the right to make informed decisions about her reproductive health.

Policies must explicitly recognize and uphold women's autonomy, including their sexual rights and their right to consent within marriage. Legal frameworks should be aligned with international human rights commitments, ensuring that women's ability to refuse sex is both protected and respected. Simultaneously, educational initiatives targeting both youths and adults should include comprehensive, culturally sensitive content on sexual rights, bodily autonomy, and consent. Establishing safe, community-based platforms for confidential support can also provide women with the resources and encouragement needed to assert control over their reproductive choices.

Acknowledgments

We are deeply grateful to the Demographic and Health Survey (DHS) program (<https://dhsprogram.com/>) for providing full access to their publicly available dataset free of charge.

Funding

None.

Conflict of interest

The authors declare that they have no competing interests.

Author contributions

Conceptualization: S. M. Mostafa Kamal, Md. Amanat Ullah

Formal analysis: S. M. Mostafa Kamal, Md. Amanat Ullah, Md. Anisur Rahman, Rehnema Ferdous, Md. Shafiul Alam Chowdhury, Mohammad Alauddin

Investigation: S. M. Mostafa Kamal, Md. Amanat Ullah, Md. Anisur Rahman, Rehnuma Ferdous

Methodology: S. M. Mostafa Kamal

Writing – original draft: S. M. Mostafa Kamal, Md. Amanat Ullah, Gazi Mahabubul Alam

Writing – review & editing: All authors

Ethics approval and consent to participate

This study used the nationally representative 2022 Bangladesh Demographic and Health Surveys (BDHS) dataset, which is publicly available from the Demographic and Health Surveys (DHS) Program website (https://dhsprogram.com/data/dataset_admin/) at no cost. The DHS program provides standardized recode files in multiple formats for public use. All DHS surveys undergo ethical review by the Institutional Review Board of the International Classification of Functioning, Disability and Health, United States. In addition, the BDHS protocol received ethical approval from the Bangladesh Medical Research Council, under the Ministry of Health and Family Welfare, Bangladesh. As the DHS data sets are de-identified and publicly available for research purposes, this study did not require additional ethical approval.

Consent for publication

As the DHS data sets are de-identified and publicly available for research purposes, consent for publication is not required.

Availability of data

The data used in this study are publicly available from the DHS Program data website: https://dhsprogram.com/data/dataset_admin/.

References

Abita, Z., & Girma, D. (2022). Exposure to mass media family planning messages and associated factors among youth men in Ethiopia. *Heliyon*, 8(9):e10544.

<https://doi.org/10.1016/j.heliyon.2022.e10544>

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50(2):179-211.

[https://doi.org/10.1016/0749-5978\(91\)90020-T](https://doi.org/10.1016/0749-5978(91)90020-T)

Alam, M.B. Rana, M.S., Kabir, M.A., Khanam, S.J., & Khan, M.N. (2024). Pattern of contraceptive use among reproductive-aged women with disabilities in Bangladesh: Evidence from multiple indicator cluster survey 2019. *Disability and Health Journal*, 17(4):101651.

<https://doi.org/10.1016/j.dhjo.2024.101651>

Alemu, A., Woltamo, T., & Abuto, A. (2022). Determinants of women participation in income generating activities:

Evidence from Ethiopia. *The Journal of Innovation and Entrepreneurship*, 11:66.

<https://doi.org/10.1186/s13731-022-00260-1>

Ali, A.S., & Abrejo, F. (2017). The relationship between contraceptive use and unintended pregnancies among married women in Thatta District, Pakistan. *Journal of Midwifery and Women's Health*, 5(3):950-957.

<https://doi.org/10.22038/jmrh.2017.8400>

Alomair, N., Alageel, S., Davies, N., & Bailey, J.V. (2020). Factors influencing sexual and reproductive health of Muslim women: A systematic review. *Reproductive Health*, 17:33.

<https://doi.org/10.1186/s12978-020-0888-1>

Arends-Kuenning, M. (2021). How do family planning workers' visits affect women's contraceptive behavior in Bangladesh? *Demography*, 38(4):481-496.

<https://doi.org/10.2307/3088313>

Bulatao, R.A. (ed.). (1989). *Choosing a Contraceptive: Method Choice in Asia and the United States*. London: Routledge.

<https://doi.org/10.4324/9780429042881>

Dhak, B., Saggurti, N., & Ram, F. (2020). Contraceptive use and its effect on Indian women's empowerment: Evidence from the National Family Health Survey-4. *The Journal of Biosocial Science*, 52(4):523-533.

<https://doi.org/10.1017/S0021932019000609>

Dias, J.G., & de Oliveira, I.T. (2015). Multilevel effects of wealth on women's contraceptive use in Mozambique. *PLoS One*, 10(3):e0121758.

<https://doi.org/10.1371/journal.pone.0121758>

Forty, J., Rakgoasi, S.D., & Keetile, M. (2021). Patterns and determinants of modern contraceptive use and intention to use contraceptives among Malawian women of reproductive ages (15–49 years). *Contraception and Reproductive Medicine*, 6:21.

<https://doi.org/10.1186/s40834-021-00166-z>

Ghosh, R., Mozumdar, A., Chattopadhyay, A., & Acharya, R. (2021). Mass media exposure and use of reversible modern contraceptives among married women in India: An analysis of the NFHS 2015–16 data. *PLoS One*, 16(7):e0254400.

<https://doi.org/10.1371/journal.pone.0254400>

Ghosh, S., & Siddiqui, M.Z. (2017). Role of community and context in contraceptive behaviour in rural West Bengal, India: A multilevel multinomial approach. *The Journal of Biosocial Science*, 49(1):48-68.

<https://doi.org/10.1017/S0021932016000080>

Hailegebreal, S., Kale, T.D., Gilano, G., Haile, Y., & Simegn, A.E. (2023). Modern contraceptive use and associated factors among reproductive-age women in Ethiopia: Multilevel analysis evidence from 2019 Ethiopia mini demographic

- and health survey. *Journal of Maternal-Fetal and Neonatal Medicine*, 36(2):e2234067.
<https://doi.org/10.1080/14767058.2023.2234067>
- Hoq, M.N. (2020). Influence of the preference for sons on contraceptive use in Bangladesh: A multivariate analysis. *Heliyon*, 6(10):e05120.
<https://doi.org/10.1016/j.heliyon.2020.e05120>
- Hossain, M., Khan, M.H.R., Ababneh, F., & Shaw, J.E.H. (2018). Identifying factors influencing contraceptive use in Bangladesh: Evidence from BDHS 2014 data. *BMC Public Health*, 18:192.
<https://doi.org/10.1186/s12889-018-5098-1>
- Hossain, M.B., & Phillips, J.F. (1996). The impact of outreach on the continuity of contraceptive use in rural Bangladesh. *Studies in Family Planning*, 27(2):98-106.
- Huda, F.A., Robertson, Y., Chowdhuri, S., Sarker, B.K., Reichenbach, L., & Somrongthong, R. (2017). Contraceptive practices among married women of reproductive age in Bangladesh: A review of the evidence. *Reproductive Health*, 14:69.
<https://doi.org/10.1186/s12978-017-0333-2>
- Islam, A.Z., Mondal, M.N., Khatun, M.L., Rahman, M.M., Islam, M.R., Mostofa, M.G., et al. (2016). Prevalence and determinants of contraceptive use among employed and unemployed women in Bangladesh. *The International Journal of Maternal and Child Health and AIDS*, 5(2):92-102.
<https://doi.org/10.21106/ijma.83>
- Islam, A.Z., Rahman, M., & Mostofa, M.G. (2017). Association between contraceptive use and socio-demographic factors of young fecund women in Bangladesh. *Sexual and Reproductive HealthCare*, 13:1-7.
<https://doi.org/10.1016/j.srhc.2017.05.001>
- Islam, M., & Habib, S.E. (2024). I don't want my marriage to end": A qualitative investigation of the sociocultural factors influencing contraceptive use among married Rohingya women residing in refugee camps in Bangladesh. *Reproductive Health*, 21:32.
<https://doi.org/10.1186/s12978-024-01763-8>
- Kamal, S.M.M., & Islam, M.A. (2012). Interspousal communication on family planning and its effect on contraceptive adoption in Bangladesh. *Asia Pacific Journal of Public Health*, 24:506-521.
<https://doi.org/10.1177/1010539511399118>
- Khatun, N., Howlader, S., & Rahman, M.M. (2023). Women's sexual empowerment and its relationship to contraceptive use in Bangladesh: Findings from a recent national survey. *The International Journal of Public Health*, 68:1606143.
<https://doi.org/10.3389/ijph.2023.1606143>
- Kumari, B., Do, M., Madkour, A.S., & Wisniewski, J.M. (2024). Women's empowerment and current contraceptive use in Pakistan: Informed by theory of gender and power. *Frontiers in Global Women's Health*, 5:1360052.
<https://doi.org/10.3389/fgwh.2024.1360052>
- Kundu, S., Kundu, S., Rahman, M.A., Kabir, H., Banna, M.H.A., Basu, S., et al. (2022). Prevalence and determinants of contraceptive method use among Bangladeshi women of reproductive age: A multilevel multinomial analysis. *BMC Public Health*, 22:2357.
<https://doi.org/10.1186/s12889-022-14857-4>
- Lahole, B.K., Banga, D., & Mare, K.U. (2024). Modern contraceptive utilization among women of reproductive age in Ghana: A multilevel mixed-effect logistic regression model. *Contraception and Reproductive Medicine*, 9:46.
<https://doi.org/10.1186/s40834-024-00310-x>
- MacQuarrie, K.L.D., & Aziz, A. (2022). Women's decision-making and contraceptive use in Pakistan: An analysis of Demographic and Health Survey data. *Sex Reproductive Health Matters*, 29(2):2020953.
<https://doi.org/10.1080/26410397.2021.2020953>
- Mutumba, M. (2022). Mass media influences on family planning knowledge, attitudes and method choice among sexually active men in sub-Saharan Africa. *PLoS One*, 17(1):e0261068.
<https://doi.org/10.1371/journal.pone.0261068>
- National Institute of Population Research and Training (NIPORT), ICF. (2024). *Bangladesh Demographic and Health Survey 2022: Final Report*. Dhaka, Bangladesh, and Rockville, Maryland, USA: NIPORT and ICF; 2024. Available from: <https://www.dhsprogram.com/pubs/pdf/FR386/FR386.pdf> [Last accessed on 2025 Jan 10].
- Naz, L., Siddiqui, U.A., & Sriram, S. (2024). Examining contraceptive utilization behavior in Pakistani women. *Reproductive Health*, 21:100.
<https://doi.org/10.1186/s12978-024-01815-z>
- Nkoka, O., Lee, D., Chuang, K.Y., & Chuang, Y.C. (2021). Multilevel analysis of the role of women's empowerment on use of contraceptive methods among married Cambodian women: Evidence from Demographic Health Surveys between 2005 and 2014. *BMC Womens Health*, 21:9.
<https://doi.org/10.1186/s12905-020-01141-z>
- Rahman, M.M., Mostofa, M.G., & Hoque M.A. (2014). Women's household decision-making autonomy and contraceptive behavior among Bangladeshi women. *Sex Reprod Healthc*, 5(1):9-15.
<https://doi.org/10.1016/j.srhc.2013.12.003>
- Rana, M.S., Khanam, S.J., Alam, M.B., Hassen, M.T., Kabir, M.I., & Khan, M.N. (2024). Exploration of modern contraceptive methods using patterns among later reproductive-aged

women in Bangladesh. *PLoS One*, 19(4):e0291100.

<https://doi.org/10.1371/journal.pone.0291100>

Sarwer, M.N., Jahan, E.A., & Chowdhury, A.I. (2024). Does women empowerment alone influence contraception utilization in Bangladesh perspective? Findings from the 2017–2018 Demographic Health Survey using a structural equation model analysis. *AJOG Global Reports*, 5(1):100434.

<https://doi.org/10.1016/j.xagr.2024.100434>

Sharif, A.B., Hasan, M.T., Naziat, M.H., Zerín, T., & Kundu, S. (2023). Permanent, long-acting and short-acting reversible contraceptive methods use among women in Bangladesh: An analysis of Bangladesh Demographic and Health Survey 2017–2018 data. *BMJ Open*, 13:e073469.

<https://doi.org/10.1136/bmjopen-2023-073469>

Teshale, A.B. (2022). Factors associated with unmet need for family planning in sub-Saharan Africa: A multilevel multinomial logistic regression analysis. *PLoS One*, 17(2):e0263885.

<https://doi.org/10.1371/journal.pone.0263885>

Tessema, Z.T., Teshale, A.B., Tesema, G.A., Yeshaw, Y., & Worku, M.G. (2021). Pooled prevalence and determinants

of modern contraceptive utilization in East Africa: A multi-country analysis of recent demographic and health surveys. *PLoS One*, 16(3):e0247992.

<https://doi.org/10.1371/journal.pone.0247992>

Tumwizere, G., Nsenga, R., Ndugga, P., & Kwagala, B. (2024). Intention to use modern contraceptives among current nonusers of reproductive age in Uganda. *Contraception and Reproductive Medicine*, 9:67.

<https://doi.org/10.1186/s40834-024-00325-4>

Yifru, G.T., Haileyesus, M.T., & Regassa, B.T. (2020). Determinants of modern contraceptive methods discontinuation among women within reproductive age in Dire Dawa City, Eastern Ethiopia. *International Journal of Reproductive Medicine*, 2020:3059435.

<https://doi.org/10.1155/2020/3059435>

Zegeye, B., Ahinkorah, B.O., Idriss-Wheeler, D., Olorunsaiye, C.Z., Adjei, N.K., & Yaya, S. (2021). Modern contraceptive utilization and its associated factors among married women in Senegal: A multilevel analysis. *BMC Public Health*, 21:231.

<https://doi.org/10.1186/s12889-021-10252-7>