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RESEARCH ARTICLE

Collective norms and modern contraceptive use in men and women: A multilevel analysis of DHS Program data in Nigeria and Zambia [version 1; peer review: 1 approved with reservations, 1 not approved]

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Abstract

Background: Social norms have long been understood as essential for demographic preferences, intentions and behavior, despite a lack of consistent definitions and measures in the field. Recent work has more clearly defined these norms, both at the individual and community/collective levels. However, past research on the effect of social norms on contraceptive use has focused mainly on the influence of individual-level norms, largely among women only, contributing to mixed findings.

Methods: This study addresses this gap through the use of multilevel models to identify associations between collective gender, fertility, and family planning norms and individual use of modern contraceptives for both men and women, using recent Demographic and Health Survey (DHS) data from Nigeria and Zambia. Multiple measures of variation, including community-level random effects and the intraclass correlation, are calculated, providing evidence of the general effect of community factors on behavior.

Results: Our findings support the importance of social, demographic and economic context on how collective gender, fertility, and family planning norms relate to modern contraceptive use. Different social norms are associated with use in the two countries, and, even within the same country, men and women's use are influenced by different norms. Among the examined norms, only collective fertility norms were associated with use for all the groups examined, consistently associated with lower use of modern contraception. Overall, clustering at the community level explained a larger proportion of

variance in individual use in men compared to women, suggesting that men's behavior was more consistently associated with the measured social norms than women's.

Conclusions: These findings suggest that careful attention should be paid to understanding and measuring social norms when considering programs or policy around the provision of modern contraception and that these should not assume that social norms influence men and women's behaviors in the same way.

Keywords

contraceptive use, family planning, social norms, gender, Nigeria, Zambia

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Introduction

The role of social norms in shaping fertility preferences, intentions, and behavior has been widely acknowledged by demographers and reproductive health researchers[1–4]. Despite this longstanding interest, however, the empirical evidence for the effect of social norms on contraceptive use has been inconclusive, reflecting a lack of consistent definitions and measures of social norms[1,5]. Recent conceptual and methodological work has provided clarity in this regard, broadly defining social norms as collectively held, often unwritten, behavioral "rules" and expectations held by social groups that define what is considered "normal" and appropriate behavior[6–8]. Norms exert particular influence over behavior when held by key 'reference groups' that include individuals whose opinions or behavior matter sufficiently to an individual to motivate compliance with the group's social expectations[9].

At the individual level, social norms may be seen as 'descriptive', reflecting individual beliefs or perceptions of how others in their reference group behave, or 'injunctive', reflecting beliefs or perceptions of what others in their reference group regard as acceptable behavior[7,10–13]. Collective norms, on the other hand, refer to the norms held by a larger societal or group level, with descriptive norms referring to the behavior of the relevant peer group and injunctive norms referring to the attitude of the peer group towards a specific behavior[12,14].

Previous research on social norms and contraceptive use has focused on individual-level norms. This approach neglects a broader, more complex view of normative influence which recognizes the multiple, interrelated social norms that may have an effect on contraceptive use. Some of these norms are specific to the use of contraception, such as desire to have a child soon, while others have a more indirect relationship, such as norms related to gender roles[1,5].

Previous studies have found that collective gender norms are significantly associated with modern contraceptive use in different settings[15–18]. However, the evidence for the effect of collective norms around fertility and family planning, such as ideal number of children and societal approval of family planning, on modern contraceptive use is not as clear[14,19,20]. Additionally, evidence shows that the same collective norm may influence men and women's contraceptive differently[21,22], indicating a more complex relationship between contraceptive use and social norms than previously thought.

This study uses nationally representative data from Nigeria and Zambia to explore associations between collective norms and individual modern contraceptive use and how these differ for men and women. Previous studies in both countries have shown that socio-cultural factors play a significant role in forming norms that impact fertility-related behavior, including norms related to gender, desire for larger families, and broader religious/cultural influences[16,23–28]. Gender norms associated with modern contraceptive use include gender-equitable attitudes towards household decision-making, couples' family planning decisions, and community-level family planning self-efficacy in Nigeria[16] and higher mean age at first birth, community justification for domestic violence, the ratio of

men's to women's employment in Zambia[15,29]. Even in socially conservative Northern Nigeria, female autonomy is significantly associated with contraceptive use[30]. While many of the social norms influencing contraceptive use are similar in both countries, there are important differences. For example, a recent study found that desired family size was negatively associated with modern contraceptive use in Nigeria, but not in Zambia[29]. Other community factors such as average level of education and ethnic diversity have also been shown to influence modern contraceptive use in Nigeria[31,32].

This study builds upon this previous literature, exploring the relative influence of social norms on men and women's contraceptive use, and through the application of a multi-level modelling approach influenced by the socioecological framework for understanding individual behavior.

Methods

Ethical review

All Demographic and Health Surveys receive ethical review by ICF's institutional review board. Before being publicly released, all DHS datasets are anonymized and geographic coordinates are offset by up to 2 km in urban areas and 5–10 km in rural areas in order to prevent identification[33].

Data. This study utilizes data from the 2018 Demographic and Health Surveys (DHS) in Nigeria and Zambia. These countries were chosen for their availability of recent DHS data, inclusion of the men's questionnaire, representation of different geographic regions of Africa, and having different contraceptive S curve classifications. Nigeria is classified as low growth and low prevalence, while Zambia is classified as the rapid growth in the S-curve classification.[1] The DHS employs a stratified two-stage cluster sampling design, with households randomly selected within Primary Sampling Units (PSUs) or clusters. Details of the methodology employed for each DHS survey can be found in the final reports[34,35]. For the purposes of this analysis, we limited the analytic sample to non-pregnant women and men in union, as we believed that the factors influencing contraceptive use would differ among those in and not in union. In Nigeria, this resulted in a final sample of 24,822 women and 6,810 men in 1,389 clusters. In Zambia, the final sample included 6,727 women and 5,715 men in 545 clusters.

Measures. The outcome of interest in this study was modern contraceptive use. The questions used to capture information relating to modern contraceptive use were slightly different for women and men, with women being asked about *current use* and men being asked about use during their *last sexual encounter*. Methods were categorized as modern according to the DHS definition of modern method[36]. Female or male condoms, contraceptive pills, emergency contraception, implants, injectables, intrauterine devices (IUDs), the lactational amenorrhea method (LAM) the standard days method, and male or female sterilization were all considered modern methods.

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[1] For more information on the S-curve, visit: http://www.track20.org/pages/data_analysis/in_depth/mCPR_growth/s_curve.php

Respondents who reported that they or their partner were using any of these methods were considered to be using modern contraception.

We examined three categories of community norms as possible influences on modern contraceptive use.

First, fertility norms were measured using the response of mean and women to the question of the number of children they would want to have if they could choose the exact number of children to have over their lifetime.

Second, gender norms were measured using the domains of the SWPER (Survey-based Women's emPowERment index) Global index. The SWPER was originally developed for African countries as an individual-level indicator that would allow for comparison of empowerment between countries and over time[37]. The measure was later improved as the SWPER Global which can applied globally[38]. Since its creation it has been used in various contexts and outcomes, including reproductive and maternal health, child growth, female genital mutilation, and child vaccination[39–42]. The SWPER consists of three domains—attitude toward violence, social independence, and women's decision-making power- which have a standardized score. A score of 0 represents the average of level of the domain relative to all women in the country's respective region (West and Central Africa for Nigeria and Southern and Eastern Africa for Zambia). Negative values then represent below average levels, and positive values represent above-average levels.

Finally, family planning norms were evaluated using two measures. The first measure assessed contraceptive decision-making through women's participation in the decision to use or not to use contraception. Women who reported that they participated in the decision-making process, either alone or jointly with their husband, were categorized as "decision-makers". On the other hand, those for whom the main decision-maker for contraceptive use or non-use was their husband or someone else were categorized as "not decision-makers". The second measure evaluated men's beliefs about contraceptive use and promiscuity. Men were asked whether they agreed or disagreed with the statement that women who use family planning (FP) may become promiscuous.

For each measure, the community-level value was calculated by taking the average value of the individual-level measures for men or women in the cluster.

Our models also included individual and community factors previously demonstrated to have associations with men or women's modern contraceptive use. At the individual level, these included age, men's education level, wealth quintile, number of children ever born, exposure to family planning messaging, and desire for children in the next two years. While women's education has also been shown to be associated with modern contraceptive use, it is one of the component variables in the SWPER and was excluded as a covariate. All individual-level values of the community norms measures were also controlled for. Community control variables include distance as a problem accessing care, place of residence, and community average years of education among men.

Additional information on the calculation of each measure can be found on The DHS Program website[43].

Analysis. We estimated modern contraceptive use prevalence for each country, then analyzed cross-tabulations of men's and women's characteristics, and community-level factors by their contraceptive use status. Chi-square and t-tests determined differences in categorical and continuous variable distributions. Finally, we used multilevel logistic regression to study the relationship between contraceptive use and community-level norms for fertility, gender, and family planning.

Models were constructed using Stata 17's *melogit* command with the cluster (community) as the grouping structure. The first model (model 0) had no covariates and estimated the intra-class correlation coefficient (ICC) of overall modern contraceptive use. Model 1 included only individual-level covariates, while the full model (model 2) included all individual- and community-level factors. Our analysis aimed to estimate contextual effects of the community-level variables above and beyond the individual-level effects of the variable, so we controlled for the individual-level values for the community-level aggregate covariates in model 2[44]. To evaluate the risk of collinearity between individual- and community-level variables, the variance inflation factor (VIF) for each variable was calculated and none had a VIF over 5. To facilitate interpretation of regression coefficients, we standardized aggregate community-level covariates to have a mean of 0 and standard deviation (SD) of 1 within each country.

We estimated multiple measures of variation for each model, including the community-level random effect, which describes the community-level variation due to unobserved covariates, as well as the ICC, which provides the proportion of the variance explained by the clustering in the population.

Individual and cluster weights were estimated and applied for all multilevel models according to DHS guidance[45].

All analysis[46] was conducted using Stata 17.

Results
Nigeria
Associations between modern contraceptive use and individual and community variables. Less than 15% of women and men in Nigeria use a modern contraceptive method (see Table 1). Modern contraceptive use differed by all individual and community level variables shown in Table 1 except for the opinion that contraception makes women promiscuous among men. At the individual level, modern contraceptive use was the lowest for men and women with no children and for those that want children soon.

At the community level, men and women from urban areas had higher percentage of use of modern methods. Modern

Table 1. Modern contraceptive use by individual- and community-level covariates in Nigeria and Zambia.

	Nigeria		Zambia	
	Women	**Men**	**Women**	**Men**
Total	14.0 [13.3,14.8]	12.1 [11.0,13.2]	53.7 [52.1,55.4]	51.1 [49.2,53.0]
Community level				
Place of residence	***	***	***	
Rural	9.2 [8.4,10.1]	9.5 [8.4,10.8]	50.4 [48.2,52.6]	50.8 [48.6,53.0]
Urban	20.8 [19.6,22.0]	14.9 [13.1,16.9]	58.5 [56.0,61.0]	51.5 [48.0,55.0]
Access to care	***	***	**	
Not a barrier	15.6 [14.7,16.6]	13.0 [11.7,14.3]	55.8 [53.9,57.7]	51.9 [49.5,54.3]
Is a barrier	8.4 [7.2,9.7]	8.4 [7.0,10.2]	48.8 [45.7,52.0]	49.3 [46.1,52.5]
Ideal number of children	***	***	***	***
Among non-users	6.72 (0.05)	8.22 (0.12)	5.23 (0.04)	5.83 (0.08)
Among users	5.43 (0.05)	5.86 (0.14)	4.99 (0.04)	5.56 (0.06)
Woman involved in contraceptive decision making	***	***		
Among non-users	0.20 (0.01)	0.18 (0.01)	0.13 (0.01)	0.13 (0.01)
Among users	0.12 (0.01)	0.13 (0.01)	0.13 (0.01)	0.13 (0.01)
Believe contraception makes women promiscuous	***		*	
Among non-users	0.38 (0.01)	0.36 (0.01)	0.37 (0.01)	0.35 (0.01)
Among users	0.34 (0.01)	0.38 (0.02)	0.35 (0.01)	0.36 (0.01)
SWPER attitude to violence	***	***	***	***
Among non-users	0.29 (0.02)	0.40 (0.02)	-0.33 (0.03)	-0.35 (0.03)
Among users	0.63 (0.01)	0.62 (0.02)	-0.22 (0.03)	-0.2 (0.02)
SWPER social independence	***	***	*	
Among non-users	0.17 (0.02)	0.42 (0.02)	-0.09 (0.03)	-0.08 (0.03)
Among users	0.77 (0.03)	0.93 (0.04)	-0.06 (0.02)	-0.07 (0.02)
SWPER decision-making	***	***	**	**
Among non-users	0.05 (0.02)	0.23 (0.02)	0.02 (0.03)	0.08 (0.02)
Among users	0.48 (0.02)	0.57 (0.03)	0.08 (0.02)	0.02 (0.02)
Individual level				
Number of children ever born	***	***	***	***
0	1.8 [1.1,2.9]	7.2 [4.1,12.3]	5.8 [3.1,10.6]	22.4 [14.0,33.8]
1–2	13.2 [12.1,14.4]	13.8 [11.9,15.9]	56.4 [53.6,59.1]	52.4 [48.9,55.8]
3+	14.0 [13.3, 14.8]	11.6 [10.4, 12.9]	54.2 [52.3, 56.1]	51.4 [49.2,53.6]
Any family planning message exposure	***	***	**	***
No	10.9 [10.2,11.7]	9.4 [8.1,11.0]	52.6 [50.8,54.5]	47.5 [45.2,49.8]
Yes	19.4 [18.2,20.7]	14.5 [13.0,16.1]	57.3 [54.3,60.3]	55.6 [52.5,58.6]

	Nigeria		Zambia	
	Women	**Men**	**Women**	**Men**
Ideal number of children	***	***	***	*
0	6.0 [4.0,8.8]	5.8 [2.2,14.5]	59.0 [45.3,71.5]	49.3 [31.1,67.7]
2–4	23.8 [22.5,25.2]	18.9 [16.6,21.4]	57.7 [55.3,60.0]	55.1 [51.6,58.5]
5+	10.6 [9.8,11.4]	9.7 [8.6,10.9]	51.0 [49.0, 53.1]	48.8 [46.5,51.1]
Desire for a(nother) child	***	***	***	***
Does Not Want Soon	18.6 [17.6,19.6]	14.8 [13.4,16.3]	59.8 [57.9,61.6]	54.9 [52.8,57.1]
Wants soon	6.4 [5.7,7.1]	8.3 [7.0,9.9]	32.0 [28.7,35.5]	38.0 [34.3,41.8]
Contraceptive decision-maker	***		***	NA
Self/joint with husband	15.5 [14.7,16.4]	NA	55.0 [53.2,56.7]	
Husband/Other	7.5 [6.5,8.8]	NA	45.2 [41.4,49.2]	
Believe contraception makes women promiscuous				
Disagree	NA	12.0 [10.7,13.5]	NA	50.8 [48.5,53.0]
Agree	NA	12.4 [10.9,14.0]		51.4 [48.3,54.4]
SWPER attitude to violence	***	NA	*	NA
Among non-users	0.30 (0.02)		-0.30 (0.03)	
Among users	0.66 (0.02)		-0.22 (0.03)	
SWPER social independence	***	NA		NA
Among non-users	0.18 (0.02)		-0.08 (0.03)	
Among users	0.75 (0.03)		-0.06 (0.02)	
SWPER decision-making	***	NA	**	NA
Among non-users	0.05 (0.02)		-0.01 (0.03)	
Among users	0.52 (0.03)		0.11 (0.03)	

Note: Estimates with square brackets are percents with 95% Confidence Intervals. Estimates with parenthesis are means with SDs.

*p<0.05, **p<0.01, ***p<0.001

contraceptive use was also significantly higher for women and men living in communities where access to care was not a barrier. The mean ideal number of children at the community level was lower among users and differed by more than one child on average among women and more than two children among men.

Table 1 also summarizes the bivariate associations between modern contraceptive use and the SWPER indices at the individual and community level. Women users had higher mean individual SWPER scores compared to non-users and the differences were significant. At the community level, users of modern contraceptive methods were consistently from communities with higher average SWPER scores. The average community SWPER score for contraceptive users was similar for men and women, except for the social independence domain, where the community average score for men who use

contraception was higher than the community average score for women who use contraception.

Multilevel logistic regression results. Figure 1 and Table 2 summarize the regression results from the full model in Nigeria for women and men. Most community-level variables had a significant association with women's modern contraceptive use. Living in a community where distance is a barrier to access and higher community-average ideal number of children were both negatively associated with women's modern contraceptive use. Higher community levels of women's involvement in contraceptive decisions, higher community average SWPER score in the attitude to violence domain, and more average years of men's education at the community level were positively associated with modern contraceptive use. Men's modern contraceptive use was significantly negatively associated with community average ideal number of children,
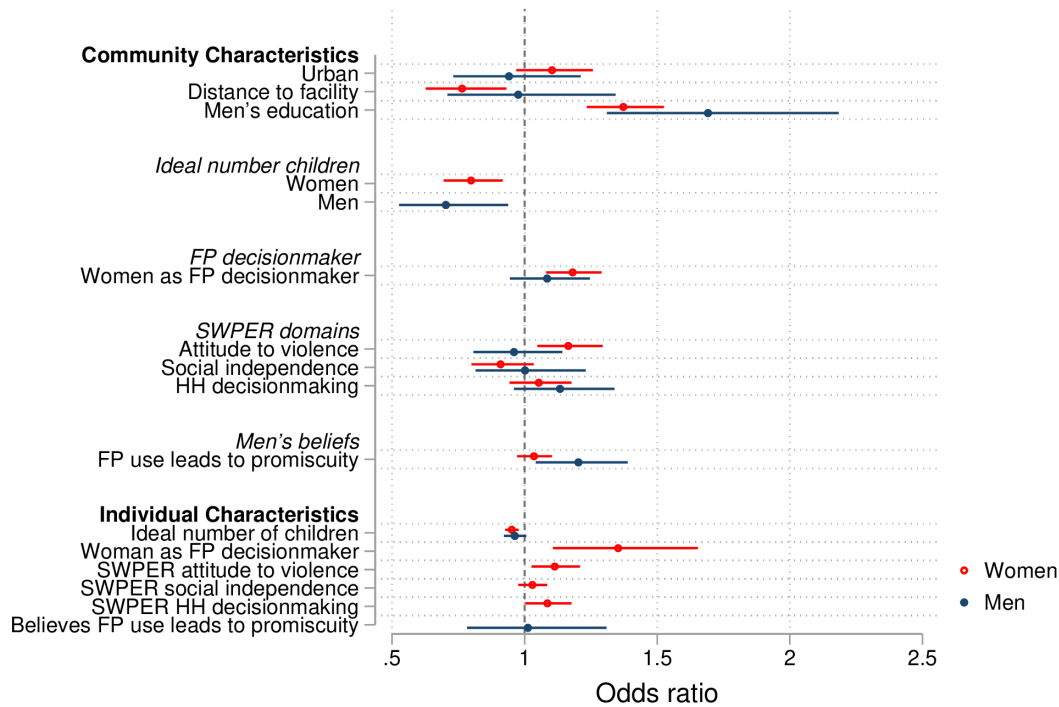
Figure 1. Coefficient plot of multilevel regression results for men and women's modern contraceptive use, Nigeria. Note: Odds ratio is per 1 SD increase for all community variables except Urban (ref: Rural) and Distance to facility is a problem (ref: Not a problem). Models also controlled for individual age, men's education, wealth quintile, parity, and FP messaging.

but positively associated with increasing years of men's education, and the percentage of men who believe FP makes women more promiscuous, with the unexpected findings that higher percentages of men in the community believing that FP makes women more promiscuous are associated with higher contraceptive use among men.

Of the individual-level covariates, only the SWPER for social independence was not statistically significantly associated with women's modern contraceptive use. For men, age and education (not shown in figure), exposure to family planning (FP) messages, and desiring a/another child soon were significantly associated with use.

As shown in Table 2, 36% of the variance in overall modern contraceptive use among women, and 43% of the variance in overall modern contraceptive use among men in Nigeria can be accounted for by cluster membership. Among women the unexplained variance due to cluster membership is cut nearly in half, to 19%, after accounting for individual- and community-level covariates, while among men it only decreases to 31%. The random effects parameter for community was statistically significant in all models for both men and women, suggesting that our models are missing key unobserved community characteristics associated with modern contraceptive use. The random effects parameter for men was higher than that for women.

Zambia

Associations between modern contraceptive use and individual and community variables. Just over half of women and men in Zambia use a modern contraceptive method (see Table 1). Bivariate analyses show both men and women had significant associations between modern contraceptive use and parity, FP message exposure, ideal number of children, and desire for another child at the individual level. Among women, there were differences in contraceptive decision-making and individual level SWPER scores for attitude to violence and decision-making between those who use modern contraception and those who do not. All the community level covariates were found to have significant associations with modern contraceptive use among women except for women's involvement in contraceptive decision-making. Among men, our analysis showed few statistically significant findings at the community level. The only community factors found to be significantly associated with men's modern contraceptive use were community average ideal number of children and community average SWPER scores for attitude to violence and decision-making.

Multilevel logistic regression results. Figure 2 and Table 3 summarize the multi-level regression results of modern contraceptive use for Zambian women and men. Living in a community where distance is a barrier to health care, community average ideal number of children, community proportion of women involved in contraceptive decision-making, and the community

Table 2. Association of collective norms and covariates with individual modern contraceptive use in Nigeria (AOR with 95% Confidence Interval).

	Women			Men		
	Model 0: Null model	Model 1: Individual level covariates only	Model 2: Full model	Model 0: Null model	Model 1: Individual level covariates only	Model 2: Full model
Collective norms (community-level)						
Urban (Ref: Rural)			1.1 [1.0 - 1.3]			0.9 [0.7 - 1.2]
Distance to health facility is barrier[1] (Ref: Not a barrier)			0.8** [0.6 - 0.9]			1.0 [0.7 - 1.3]
Average ideal number of children			0.8** [0.7 - 0.9]			0.7* [0.5 - 0.9]
% women involved in contraceptive decisions			1.2** [1.1 - 1.3]			1.1 [0.9 - 1.2]
Average SWPER attitude to violence			1.2** [1.0 - 1.3]			1.0 [0.8 - 1.1]
Average SWPER social independence			0.9 [0.8 - 1.0]			1.0 [0.8 - 1.2]
Average SWPER decision making			1.1 [0.9 - 1.2]			1.1 [1.0 - 1.3]
Average years men's education			1.4** [1.2 - 1.5]			1.7** [1.3 - 2.2]
% men believe FP makes women more promiscuous			1.0 [1.0 - 1.1]			1.2* [1.0 - 1.4]
Individual-level variables						
Younger age[2] (Ref: Older age)		1.2* [1.0 - 1.5]	1.3** [1.1 - 1.5]		1.2 [0.9 - 1.5]	1.3* [1.0 - 1.7]
Primary education (Ref: No education)		1.4** [1.1 - 1.8]	1.2 [0.9 - 1.5]		2.1* [1.2 - 3.7]	1.4 [0.7 - 2.5]
Secondary+ education (Ref: No education)		2.4** [1.9 - 3.1]	1.6** [1.3 - 2.1]		4.0** [2.3 - 6.9]	2.3** [1.3 - 4.3]
Second Wealth Quintile (Ref: Lowest)		3.6** [2.8 - 4.6]	2.1** [1.6 - 2.8]		1.5 [0.9 - 2.6]	1.3 [0.8 - 2.2]
Middle Wealth Quintile (Ref: Lowest)		4.1** [3.1 - 5.2]	2.3** [1.7 - 3.0]		1.4 [0.8 - 2.4]	1.0 [0.6 - 1.7]
Fourth Wealth Quintile (Ref: Lowest)					1.5 [0.9 - 2.5]	0.9 [0.5 - 1.6]
Highest Wealth Quintile (Ref: Lowest)					1.6 [0.9 - 2.8]	0.9 [0.5 - 1.7]
Parity		1.1** [1.0 - 1.1]	1.1** [1.1 - 1.1]		1.0 [1.0 - 1.0]	1.0 [1.0 - 1.1]
Exposed to any FP message (Ref: Not exposed)		1.2* [1.0 - 1.4]	1.2* [1.0 - 1.3]		1.4* [1.0 - 1.8]	1.4* [1.0 - 1.8]
Ideal number of children		0.9** [0.9 - 0.9]	1.0** [0.9 - 1.0]		0.9** [0.9 - 1.0]	1.0 [0.9 - 1.0]
Wants a/nother child soon (Ref: Does not want another child soon)		0.3** [0.3 - 0.4]	0.3** [0.3 - 0.4]		0.5** [0.4 - 0.7]	0.5** [0.4 - 0.7]
Woman involved in contraceptive decision-making (Ref: Not involved)		1.5** [1.2 - 1.8]	1.4** [1.1 - 1.7]			
SWPER attitude to violence		1.2** [1.1 - 1.3]	1.1* [1.0 - 1.2]			
SWPER social independence		1.1* [1.0 - 1.1]	1.0 [1.0 - 1.1]			
SWPER decision making		1.1** [1.1 - 1.2]	1.1* [1.0 - 1.2]			
Believes FP makes women more promiscuous (Ref: Does not believe)					1.1 [0.9 - 1.4]	1.0 [0.8 - 1.3]
Random effect	6.4** [5.2 - 8.0]	2.4** [2.1 - 2.7]	2.2** [1.9 - 2.5]	12.3** [7.6 - 20.1]	4.6** [3.1 - 6.8]	4.5** [3.0 - 6.6]
Observations	24,822	22,888	22,666	6,810	6,079	6,079
Number of groups	1,389	1,389	1,369	1,372	1,352	1,352
ICC	0.361	0.208	0.192	0.433	0.318	0.313

** p<0.01, * p<0.05

[1] Defined as over 50% of interviewed women in the cluster reported that distance was a barrier in accessing health care;

[2] Women: younger = age 15–29, older = age 30–49 Men: younger = age 15–34, older = age 35–59
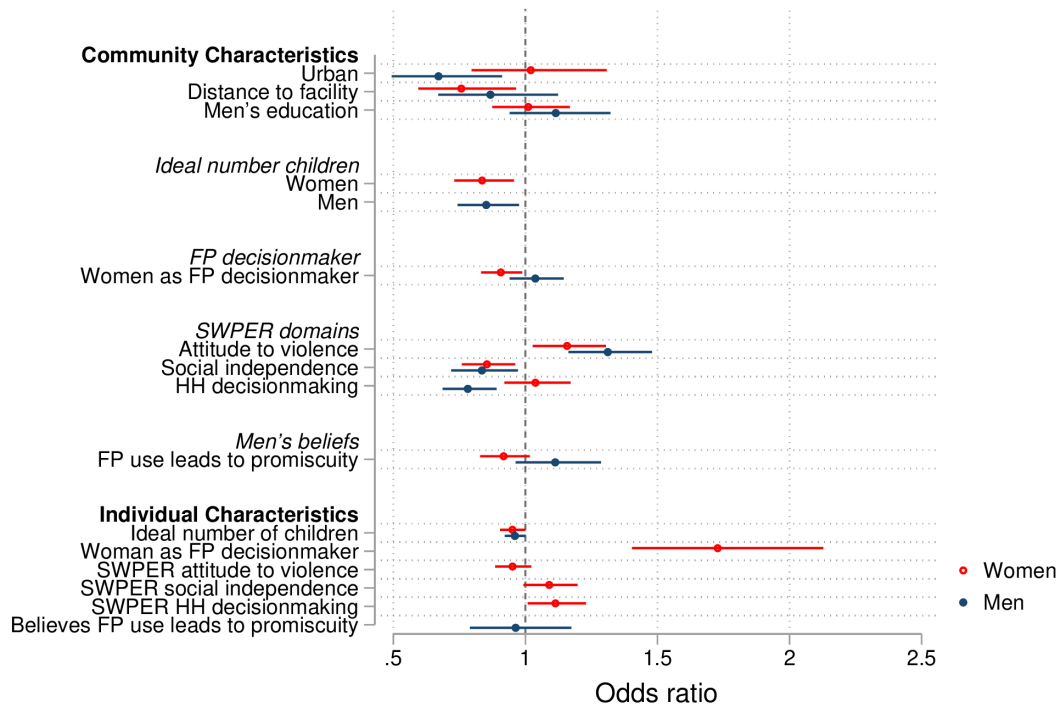
Figure 2. Coefficient plot of multilevel regression results for men and women's modern contraceptive use, Zambia. Note: Odds ratio is per 1 SD increase for all community variables except Urban (ref: Rural) and Distance to facility is a problem (ref: Not a problem). Models also controlled for individual age, men's education, wealth quintile, parity, and FP messaging.

average SWPER social independence were negatively associated with women's modern contraceptive use, while increasing community-level attitude to violence, which indicates lower acceptance of domestic violence, was positively associated with women's modern contraceptive use.

The community-level variables of urbanicity, ideal number of children, and all three SWPER domains were significantly associated with men's modern contraceptive use in Zambia. However, there was a negative association between use and urbanicity, and the SWPER for social independence and decision-making which was not in the expected direction.

For women, many individual-level characteristics, including ideal number of children, desire for a/nother child, whether she is a contraceptive decision-maker, and her SWPER decision-making score, were all significantly associated with modern contraceptive use. A man's age, wealth quintile, number of living children, previous exposure to FP messages, his ideal number of children, desire for a/nother child were associated with his modern contraceptive use.

In Zambia, 20% of the variance in overall modern contraceptive use among women, and 27% of the variance in overall modern contraceptive use among men can be accounted for by cluster membership (See Table 3). Among women

the unexplained variance due to cluster membership only decreased slightly to 18%, after accounting for individual- and community-level covariates, while among men it only decreases to 25%. Just as for Nigeria, the random effects parameter for community was statistically significant in all models for both men and women. However, the random effects parameters for men and women were both similar to each other in the Zambia models.

Discussion

This is one of the first studies to apply the new approach to calculate level weights for Demographic and Health Survey (DHS) data. It is also innovative in its contrasting of the effects of collective norms on men and women's modern contraceptive use. The results of this study indicate that the effect of collective fertility, gender, and family planning norms on modern contraceptive use differ between men and women.

The only consistent finding for both men and women in both Nigeria and Zambia is that the collective fertility norm was consistently found to have a negative association with modern contraceptive use among both men and women. Pronatalist norms such as high ideal numbers of children have been associated with higher levels of opposition to and lower demand for contraception[46]. This can also be explained by religious and cultural beliefs previously found in both Nigeria and

Table 3. Association of collective norms and covariates with individual modern contraceptive use in in Zambia (AOR with 95% Confidence Interval).

	Women			Men		
	Model 0: Null model	Model 1: Individual level covariates only	Model 2: Full model	Model 0: Null model	Model 1: Individual level covariates only	Model 2: Full model
Collective norms (community level)						
Urban (Ref: Rural)			1.0 [0.9 - 1.1]			0.7* [0.5 - 0.9]
Distance to health facility is barrier[1] (Ref: Not a barrier)			0.8* [0.6 - 1.0]			0.9 [0.7 - 1.1]
Average ideal number of children			0.8** [0.7 - 1.0]			0.9* [0.7 - 1.0]
% of women involved in contraceptive decisions			0.9* [0.8 - 1.0]			1.0 [0.9 - 1.1]
Average SWPER attitude to violence			1.2* [1.0 - 1.3]			1.3** [1.2 - 1.5]
Average SWPER social independence			0.9** [0.8 - 1.0]			0.8* [0.7 - 1.0]
Average SWPER decision making			1.0 [0.9 - 1.2]			0.8** [0.7 - 0.9]
Average years men's education			1.0 [0.9 - 1.2]			1.1 [0.9 - 1.3]
% men believe FP makes women more promiscuous			0.9 [0.8 - 1.0]			1.1 [1.0 - 1.3]
Individual-level variables						
Younger age[2] (Ref: Older age)		1.7** [1.4 - 2.1]	1.7** [1.4 - 2.1]		1.9** [1.5 - 2.4]	1.8** [1.4 - 2.3]
Primary education (Ref: No education)					0.7 [0.5 - 1.0]	0.7 [0.5 - 1.1]
Secondary+ education (Ref: No education)					1.0 [0.7 - 1.4]	1.0 [0.7 - 1.5]
Second Wealth Quintile (Ref: Lowest)		1.2 [1.0 - 1.5]	1.2 [1.0 - 1.5]		1.2 [0.9 - 1.4]	1.2 [0.9 - 1.5]
Middle Wealth Quintile (Ref: Lowest)		1.4** [1.1 - 1.8]	1.4* [1.1 - 1.8]		1.4* [1.1 - 1.9]	1.5* [1.1 - 2.0]
Fourth Wealth Quintile (Ref: Lowest)		1.6** [1.2 - 2.1]	1.4* [1.0 - 2.0]		1.6* [1.1 - 2.2]	1.6* [1.1 - 2.4]
Highest Wealth Quintile (Ref: Lowest)		1.4 [1.0 - 1.9]	1.2 [0.8 - 1.8]		1.9** [1.3 - 2.7]	2.0** [1.3 - 3.0]
Parity		1.0 [1.0 - 1.1]	1.0 [1.0 - 1.1]		1.1** [1.0 - 1.1]	1.1** [1.0 - 1.1]
Exposed to any FP message (Ref: Not exposed)		1.1 [0.9 - 1.3]	1.1 [0.9 - 1.3]		1.3* [1.1 - 1.7]	1.3* [1.1 - 1.7]
Ideal number of children		0.9* [0.9 - 1.0]	0.9* [0.9 - 1.0]		1.0* [0.9 - 1.0]	1.0* [0.9 - 1.0]
Wants a/nother child soon (Ref: Does not want another child soon)		0.2** [0.2 - 0.3]	0.2** [0.2 - 0.3]		0.5** [0.4 - 0.6]	0.5** [0.4 - 0.6]
Woman involved in contraceptive decision-making (Ref: Not involved)		1.7** [1.4 - 2.1]	1.7** [1.4 - 2.1]			
SWPER attitude to violence		1.0 [0.9 - 1.0]	1 [0.9 - 1.0]			
SWPER social independence		1.1 [1.0 - 1.2]	1.1 [1.0 - 1.2]			
SWPER decision making		1.1* [1.0 - 1.2]	1.1* [1.0 - 1.2]			
Believes FP makes women more promiscuous (Ref: Does not believe)					1.0 [0.8 - 1.2]	1.0 [0.8 - 1.2]
Random effect	2.2** [1.8 - 2.7]	2.2** [1.8 - 2.7]	2.0** [1.7 - 2.4]	3.3** [2.6 - 4.2]	3.6** [2.8 - 4.7]	3.0** [2.3 - 3.8]
Observations	6,241	5,683	5,683	5,304	5,051	5,051
Number of groups	507	507	507	507	507	507
ICC	0.195	0.196	0.177	0.267	0.280	0.249

** p<0.01, * p<0.05

[1] Defined as over 50% of interviewed women in the cluster reported that distance was a barrier in accessing health care;

[2] Women: younger = age 15-29, older = age 30-49 Men: younger = age 15-34, older = age 35-49

Zambia which see children as "gifts" from God as well as dividends for old age and hence the more you can bear, the better[48,49].

The associations of other norms with contraceptive use were not as consistent. While gender norms, and specifically women's empowerment norms, emerged as an important influence on women's contraceptive use in both Nigeria and Zambia, different domains of the SWPER influenced the outcome in different directions. While previous studies have shown that community-level gender norms and women's empowerment positively influence women's contraceptive use[15–18], we find that in Zambia, living in communities with women of higher average social independence negatively influences women's modern contraceptive use. There have been relatively few applications of the SWPER index, our measure of women's empowerment, to contraceptive use. In one of the available studies, women in India had a similar inverse relationship between the social independence domain of the SWPER and demand satisfied with modern methods[50]. This is surprising, as women's educational attainment, one of the heavily weighted variables in the social independence domain, has been associated with modern contraceptive use in Nigeria and Zambia[31,51]. The influence of women's educational attainment may be counteracted by some of the other important variables in the social independence domain, such as age at first cohabitation and age of woman at first birth. It may be that in communities where the average age of women at these life events is higher, they are less likely to use contraception in general in order to have children. Further research should explore the associations between other key variables in the social independence domain to better understand its associations with contraceptive use.

We see the opposite association for women living in communities with higher average attitude toward domestic violence scores (indicating lower acceptance of domestic violence), which was associated with higher odds of modern contraceptive use in both Zambia and Nigeria. This relationship between non-acceptance of domestic violence and contraceptive use is consistent with previous studies from West and Central Africa that show that women who reside in communities where wife-beating is accepted have lower odds of using modern contraceptive, perhaps due to inability to control their reproductive behavior[52]. In Zambia we see the same positive association of community-level non-acceptance of domestic violence and men's contraceptive use. Living in communities with higher levels of women's empowerment as measured by non-acceptance of domestic violence and household decision-making power and ability to distribute family resources for individual health needs may improve demand and self-efficacy for accessing and use of modern contraceptives at an individual level.

In the case of non-acceptance of domestic violence in Nigeria and social independence and household decision-making in Zambia, we found significant associations for women's contraceptive use at the community-level but not at the individual level. In multilevel models, when the community-level average of an individual-level characteristic is significantly associated with an outcome even after controlling for the individual-level characteristic, it can be referred to as a "contextual" effect. This can indicate that the independent variable influences the outcome through the collective norm rather than as an individual level characteristic[53].

Although living in communities with higher average women's household decision-making scores was not significantly associated with modern contraceptive use in most cases, the association with living in communities with more women being involved specifically in *family planning* decision-making was significant for women. However, the direction of that effect differed between the two countries – influencing women's contraceptive use positively in Nigeria and negatively in Zambia. We consider this finding above and beyond the effect of the individual woman being involved in family planning decisions, which had a positive effect on women's contraceptive use in both countries. The Nigeria findings add to previous evidence of a positive association between community-level women's involvement in family planning decisions and contraceptive use[16]. In our family planning decision-making variable, we combined women who make family planning decisions by themselves with those who make decisions jointly with their husbands into one category showing women having any involvement in the decisions. In both Zambia and Nigeria, the category of joint decision-making was much larger than women making the decision alone. In Zambia, increasing male involvement in family planning decisions may decrease contraceptive use among women[54]. It may be that in the context of Zambia, the collective norm of women being involved in family planning decisions, including a large share of joint decision-making, also has a negative effect on modern contraceptive use. Future qualitative data could explore this possible pathway.

Community-level random intercepts were consistently significant in multilevel model for both men and women, in both countries. This, combined with ICCs of the multilevel models ranging from 18–31%, indicates that there is significant variation between communities that is not accounted for by the covariates included in our models. Although we included measures of community and individual social norms, access, and demand generation, there are likely additional cultural, religious, and contextual factors which also influence contraceptive use.

We were most interested in examining the influence of community-level norms on modern contraceptive use, however we also identified certain individual-level characteristics, specifically the desire for a/nother child soon and a woman's involvement in contraceptive decision-making, were associated with women's modern contraceptive use in both countries. Desire for a/nother child soon was also associated with men's report of modern contraceptive use in both countries. The effect of the desire to have a/nother child soon was expected since those men and women who want to have a child soon would likely not be using any form of contraception. These findings are consistent with other work identifying

individual-level determinant of women's modern contraceptive use[55,56].

The use of DHS data limits this analysis in some ways. First, the defining factor in a DHS clusters are household's proximity to each other. However, these households may not form a "community" and the other individuals in a cluster may not represent individuals' actual reference group. Second, our approach of using aggregated community-level measures may be result in errors in the estimates when based on clusters with small sample sizes. However, we tested for this with sensitivity analyses, removing clusters with fewer than 10 individuals, and found similar community-level results. Data collected in DHS surveys are limited, therefore this study did not include all collective norms that may affect contraceptive use. In addition, certain country-specific community measures, such as ethnicity and religion, were not available for both countries. Finally, since DHS data are cross-sectional, causality cannot be established.

Despite these limitations, this study is innovative in its direct comparison of the effects of collective norms on modern contraceptive use among men and women, and in its application of the new DHS multilevel weights in the calculation of those effects.

Conclusion

Our study reveals variations in the influence of community-level norms on the use of modern contraception by men and women in Nigeria and Zambia. In particular, the effects of gender norms at the community level were found to be heterogeneous,

depending on the country and whether we were examining men's or women's contraceptive use. However, we observed a consistent positive impact of fertility norms on the use of modern contraceptives among women in both countries.

Where possible, future work on the effect of collective norms should incorporate recent advances in measurement of social norms[57], include different types of norms, such as perceived and/or injunctive norms, as well as compare the effects of norms on use of different types of contraceptives or covert *versus* non-covert use of contraception.

Data availability
Underlying data
Data used in this study are from the individual recode (IR) and male recode (MR) datasets of the Nigeria 2018 DHS and Zambia 2018 DHS, available from the Demographic and Health Survey (DHS) website. Access to the dataset requires registration and is granted only for legitimate research purposes. A guide for how to apply for dataset access is available at: https://dhsprogram.com/data/Access-Instructions.cfm.

Extended data
Analysis code available from: https://github.com/DHSProgram/DHS-Analysis-Code/tree/main/AS82_community_norms

Archived analysis code at time of publication: https://doi.org/10.5281/zenodo.7644348[46]

License: MIT

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? **Rose Stevens** iD

University of Oxford, England, UK

<u>Summary of article</u>

This article examines the impact of individual and collective norms on contraceptive use in Nigeria and Zambia. They start with bivariable comparisons of all variables of interest with contraceptive use. Then they create multilevel models, including different level factors at different stages to predict contraceptive use. They conclude that collective norms are important but differ by gender and country.

<u>Minor comments</u>

Abstract
1. Methods: "multiple measures of variation" – variation in what?

2. Results: "norms are associated with use" – please specify use of what?

Introduction
1. "Previous research on social norms and contraceptive use has focused on individual-level norms." – please cite some of this research or a review, and change to 'predominantly' focused on, because you go on to cite research that focuses on collective norms.

2. Useful scene setting for both countries.

Methods
1. Please define briefly what the contraceptive S curve is for readers. The footnote is useful, but a quick sentence here would be good in text.

2. Ideally, future analyses would consider those not in unions as well as social norms likely have great impacts on their contraceptive use and they are likely to be adolescents who often have the greatest impacts of unintended pregnancies. For another paper perhaps.

3. I would love to see this analysis split by hormonal and non-hormonal modern methods, to see how norms differentially impact method choice – but again, probably for another paper.

4. Community-level calculations – it would be useful to understand the average size of a cluster, how they're selected, differences between urban and rural locations etc.

5. The description of included covariates is useful. It could do with some citations for justification of inclusion and preferably including the different variable levels modelled for each covariate (maybe in brackets after each variables). It strikes me that there are a lot of these. I understand that this is the epidemiological approach to include all possibly biasing factors and adjust for them in an additive model. However, I would encourage the authors to have a think about the relationship between covariates and check that there is no risk of colliding effects , and maybe make a causal diagram to think through these relationships. It's not necessary to include in the paper if not desirable, but I think it would be useful to check for themselves. See: Tennant *et al.,* (2021)[1].

6. Analysis description was clear and informative.

7. Given the setting out of injunctive and descriptive norms in the introduction – it would be good to understand which of the norms included in this analysis represent which types of norms.

Results

1. Table 1 - I found this table a little difficult to interpret. For the first two variables, it appears that the figures show modern contraceptive prevalence by different levels of that variable. Then for the following 6 variables it appears to be the average of that variable split by users and non-users – I'm not sure what '0.2 women involved in contraceptive decision making' is representing. And the same for the variable below. For the SWPER scores, I assume these are scaled scores? It would be good to either have the table split up or to have more details in the footnote. Basically, it would be great if it was generally more intuitive to interpret.

2. The explanation of the different levels of variation and how much is explained by the models is very clear, interesting, and valuable.

Discussion

1. The discussion brings together the results well and brings in relevant literature. I think it could be strengthened through a bit more contextual literature from each country helping explain the findings. Though I appreciate there are a lot of findings to explain and the strength of the paper lie in bringing them all together, so I wouldn't expect a huge amount more discussion.

2. The limitations section is well explained.

References

1. Tennant PWG, Murray EJ, Arnold KF, Berrie L, et al.: Use of directed acyclic graphs (DAGs) to identify confounders in applied health research: review and recommendations.*Int J Epidemiol*. 2021; **50** (2): 620-632 PubMed Abstract | Publisher Full Text

Is the work clearly and accurately presented and does it cite the current literature?

Yes

Is the study design appropriate and is the work technically sound?
Yes

Are sufficient details of methods and analysis provided to allow replication by others?
Partly

If applicable, is the statistical analysis and its interpretation appropriate?
Partly

Are all the source data underlying the results available to ensure full reproducibility?
Yes

Are the conclusions drawn adequately supported by the results?
Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Contraceptive side-effects, unmet need, reproductive justice, anthropology, demography

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Reviewer Report 13 July 2023

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❌ **Emma Pliskin** [iD]

Child Trends, Bethesda, Maryland, USA

The study uses recent DHS data from men and women who are not pregnant and who are in a union to assess individual and community level norms on modern contraceptive method use in Nigeria and Zambia. The authors use multilevel logistic regressions to assess the association between norms and method use. They found different associations between the two countries, and within country, different associations between men and women. Pronatalist fertility norms were consistently negatively associated with contraceptive method use in both countries. While women's empowerment factors had a positive association with method use in Nigeria, it had a negative association with method use in Zambia. In terms of individual factors, desire for another child was consistently negatively associated with contraceptive method use. The authors conclude

that community norms have a significant influence over method use, particularly fertility norms.

Background and introduction:
The work is clearly presented, though I would love more details in the introduction on the rates of method use in Nigeria and Zambia, any other studies that have determined individual level associations with method use, and a description of why these two countries were chosen in particular. We also need more background on the cultural contexts of these two countries, their health systems, etc.
We need a definition of what the S curve is and why this lead them to choose Nigeria and Zambia.

It would be helpful to read a clear articulation on why this work is important – are there efforts to increase contraceptive method use in these countries, and having a better understanding of the norms that influence use may help public health professionals to design interventions?

Research design and methods:
In order to study community-level norms, a multilevel model is an appropriate choice. Considering men and women separately, given the different outcome measures (current use versus use at last sex) is ideal.

I have never heard the term "modern contraceptive use" to include condoms and natural family planning methods, or emergency contraception. They should either change this definition or justify why they're including these methods. Cite previous studies that define this particular collection of methods as "modern"

The introduction suggests that religious norms play a role in these countries, but then they don't include any variables related to religion in their models – why?

The authors didn't mention men's ability to accurately report on method use of their partner as a limitation. Women might select their method because they don't want their partner to know. This needs to be acknowledged as a limitation, or they should just focus on condom use for men.

The authors mention the limits of the DHS's cluster definition, but in the methods section never define what a cluster or a community means, and how it's operationalized in the study. I need more information as well on how clusters were defined, and why each regional cluster was salient. "Community" is quite a complex concept, and the relevance of community norms is entirely dependent on the definition of the community, so we need more details to help understand and justify why they defined each cluster the way they did.
I would love more details on the reasons each covariate was selected, and why, and exactly how it's coded. In particular, I would love much more detail on the social empowerment scale. I didn't realized what the components of this measure were until reading the results and discussion section; all measures should be clearly described in the methods section. If necessary, add an appendix with the exact survey questions, and a description of how the variables were created using the survey questions.
Additionally, I'm not clear why the male analysis was limited to men in unions, but the female analysis wasn't similarly limited. Union status is significantly associated with method use among women, and should be considered either as a covariate or a feature defining the denominator. Given that the authors attempt to compare men and women (albeit, not statistically) the denominators should be as close as possible. Additionally, authors should describe what they

mean by "union" – is this just marriages, or does it include couples who are cohabitating, or couples who are not cohabitating?

The authors should consider limiting the denominator to those who are not currently trying to get pregnant (also describe as people "in need" of family planning services), given that this is a population of significant public health interest. Furthermore, non-use of a method when someone is trying to get pregnant is very different than non-use of a method for any other reasons. The authors could more clearly see the impact of community level fertility norms on ambivalent method use choices.

The paragraph describing the covariates that were selected doesn't include any citations – the selection of variables in the models should be clearly justified.

The methods section should describe how missingness and outliers were addressed.

A description of how and why the community level factors were centered would be helpful, in addition to how this contributes to the interpretation of the results.

Is the work clearly and accurately presented and does it cite the current literature?
Partly

Is the study design appropriate and is the work technically sound?
No

Are sufficient details of methods and analysis provided to allow replication by others?
No

If applicable, is the statistical analysis and its interpretation appropriate?
I cannot comment. A qualified statistician is required.

Are all the source data underlying the results available to ensure full reproducibility?
Partly

Are the conclusions drawn adequately supported by the results?
Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: My research work is in public health, specifically the sexual and reproductive health field, with a particular focus on contraceptive method use, access, satisfaction, and preferences. I have several published peer-reviewed articles covering various topics about contraceptive method use. Additionally, I have a Master of Public Health.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to state that I do not consider it to be of an acceptable scientific standard, for reasons outlined above.