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Predictors of modern contraceptive use among women and men in Uganda: a population-level analysis

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ABSTRACT

Objective(s) Despite substantial and rapid improvements in contraceptive uptake in Uganda, many women continue to have unmet need for contraception. As factors affecting contraceptive use are dynamic and complex, this study seeks to identify current predictors and provide effect size estimates of contraceptive use among women and men in Uganda.

Study design A nationally representative cross-sectional population survey, using secondary data from Uganda's 2016 Demographic and Health Survey. Stratified by sex, weighted bivariable and multivariable logistic regression models were derived from a suite of potential predictor variables. Predictive abilities were assessed via 10-fold cross-validated area under the receiver operating characteristic curves (AUCs).

Setting Uganda.

Participants All women aged 15–49 years who were permanent residents of the selected households or stayed in the household the night before the survey were eligible to participate. In one-third of the sampled households, all men aged 15–54 years who met the same residence criteria were also eligible.

Primary outcome measures Modern contraceptive use.

Results Overall, 4914 (26.6%) women and 1897 (35.6%) men reported using a modern contraceptive method. For women and men, both demographic and proximate variables were significantly associated with contraceptive use, although notable differences in effect sizes existed between sexes—especially for age, level of education and parity. Predictively, the multivariable model was acceptable for women with AUC=0.714 (95% CI 0.704 to 0.720) but less so for men with AUC=0.654 (95% CI 0.636 to 0.666).

Conclusion(s) Contemporary significant predictors of contraceptive use among women and men were reported, thereby enabling key Ugandan subpopulations who would benefit from more targeted family planning initiatives to be identified. However, the acceptable AUC for women and modest AUC for men suggest that other important unmeasured predictors may exist. Nonetheless, these evidence-based findings remain important for informing future programmatic and policy directions for family planning in Uganda.

Strengths and limitations of this study

- This is the first study of predictors of modern contraception among women and men using nationally representative data from the latest 2016 Uganda Demographic and Health Surveys, and therefore provides an updated, accurate reflection of current contraceptive use in Uganda.
- The study considers a group of demographic and proximate predictor variables and provides a series of models that adjust for confounding and potential mediator effects between the variables, to arrive at a final parsimonious predictive model.
- The study provides a quantitative analysis of men's contraceptive use and predictors of men's contraceptive behaviour in Uganda, which has been a largely understudied area in the past.
- The receiver operating characteristic curve yielded less than adequate predictive power in the final model for men, which suggests that there may be important unmeasured factors omitted from the model.
- The study relied on secondary data for which psychometric properties of the tools were not readily available, and while response rates were good, respondents who did not participate are likely to have lower contraceptive use and poorer health-seeking behaviours than those who did participate.

INTRODUCTION

Contraceptive use is a key facet of sexual and reproductive health, and is crucial to averting maternal deaths that result from high-risk and/or unintended pregnancies and unsafe abortions.[1] Uganda has seen improvements in the use and provision of contraceptive services over the last decade[2]; however, unmet need among women (those who are sexually active and want to avoid, space or limit a pregnancy, but who are not using a modern contraception method) remains high—estimated at 28% of all married women and 32% of sexually active unmarried women of reproductive age in 2016.[3] Uganda has one of the highest maternal mortality rates in the East African region, at 343 maternal deaths per 100 000 live births in 2015,[4] yet one of the lowest contraceptive use prevalence rates

within this region.[5] Among postpartum women (those within 2 years of their last birth), only 25% currently used contraception, with 41% seeking longer spacing between births and 27% wishing to limit the number of births.[6] These figures underscore the high maternal health burden faced by Ugandan women of reproductive age.[2]

Previous studies have explored different factors and barriers that contribute to unmet need; some of the recurring themes include misconceptions and myths about contraception, poor management of side effects, partner opposition, societal and gender norms, and issues around service provision.[7–9] Higher educational levels and socioeconomic status among women, as well as older age, higher parity and urban place of residence have shown associations with higher rates of contraceptive use.[10–12] For men, a lack of knowledge, fear of their partners experiencing side effects and dissatisfaction with male contraceptive methods have been barriers to their involvement in reproductive health.[13–15] Furthermore, while men's participation in the family planning process has been recognised as being critical to its effectiveness, traditional gender norms and perceptions dictate that pregnancy, family planning and reproductive health are a woman's 'business', and thereby exclude men's involvement in the process.[7 16 17] Unequal and male-dominated power relations between men and women in Uganda's largely patriarchal society are also often mentioned as being critical to women's contraceptive decision-making and use.[18 19]

The Ugandan government recognises that family planning is central to its economic development; the Ministry of Health's most recent initiative, the Uganda Family Planning Costed Implementation Plan 2015–2020, has the national goals 'to reduce unmet need for family planning to 10% and to increase the modern contraceptive prevalence rate to 50% by 2020'.[20] Given that contraceptive use has significantly changed over time in Uganda,[2] and recognising that factors and barriers associated with contraceptive use are dynamic and complex, a thorough contemporary understanding of the determinants of women and men's contraceptive behaviour is essential to address the current unmet need for contraception. Furthermore, male contraceptive behaviour has been a largely understudied area in the past, yet male involvement in family planning, both as clients and partners,[21] remains a key focus of reproductive health programme. Using the country's most recent Demographic and Health Surveys (DHS) 2016 dataset, this paper seeks to identify current predictors of contraceptive use among women and men in Uganda. The DHS is a nationally representative, cross-sectional population survey of women and men of reproductive age using a stratified, two-stage cluster design.[22] The study's findings provide an empirical evidence base that can be employed to inform and improve family planning programmes to more effectively meet the reproductive health needs of the Ugandan population.

MATERIALS AND METHODS

Study design

A nationally representative cross-sectional population survey.

Setting and participants

All Ugandan women aged 15–49 years who were either permanent residents of the selected households or visitors who stayed in the household the night before the survey were eligible to participate. In one-third of the sampled households, all Ugandan men aged 15–54 years, who met the same residence criteria as described for women, were also eligible.

Primary variable

'Modern contraceptive use' was derived from the existing DHS variable on current contraceptive use by method type, with responses dichotomised into no (not using a method, uses a traditional method, uses a folkloric method) and yes (uses a modern method). The existing DHS variable excluded women who were pregnant and both women and men who had never had sex. Modern methods referred to any of the following: female sterilisation, male sterilisation, oral contraceptive pills, the intrauterine contraceptive device, injectables, implants, male and/or female condoms, diaphragms, contraceptive foam and contraceptive jelly, and lactational amenorrhoea method, and other modern contraceptive methods (including cervical cap, contraceptive sponge and others). Traditional methods referred to periodic abstinence (rhythm/calendar method), or withdrawal. Folkloric methods referred to locally described methods and spiritual methods of unproven effectiveness, such as amulets and herbs. Women's and men's responses to modern contraceptive use included methods used by their partner, as well as methods requiring couple negotiation (condom use or abstinence).

Potential predictor variables

Age, education level, place of residence, region of residence, marital status, religion, parity, wealth index, hearing about family planning through the media and discussing family planning with a health worker were considered as being potential predictors of modern contraceptive use for women and men. For women, three additional variables were also available and included: if distance to the health facility was a problem; if getting money for treatment was a problem; and if getting permission to seek treatment was a problem. The definitions, original DHS categories and details about the groupings for each of these variables can be found in online supplementary appendix A, table A.1.

Data sources and measurement

The DHS are country-wide cross-sectional surveys commissioned by the United States Agency for International Development and periodically carried out by the governments of different countries, with operational support from ICF International. Datasets are available

through application to MEASURE DHS. The surveys use standardised questionnaires developed by MEASURE DHS specifically for women, men and households; these are administered during face-to-face interviews. Detailed methodological information can be found on the MEASURE DHS webpage (https://dhsprogram.com/data/), and DHS reports for respective countries.[23]

Statistical methods

Reporting of analyses were informed by the Strengthening the Reporting of Observational Studies in Epidemiology guidelines (www.strobe-statement.org).[24] Analyses were conducted separately on women's and men's datasets, using specialist statistical software Stata SE V.16.0 (StataCorp, College Station, Texas, USA), and accounting for the stratified two-stage cluster design and sample weightings. Unweighted sample numbers were reported, together with their associated weighted percentages. Initially, bivariable logistic regression models were employed for each potential predictor variable to assess their association with modern contraceptive use. All demographic variables were then considered together (model 1). Next, proximal variables were collectively added to provide insight into their potential confounding or moderating effects (model 2). Finally, parsimonious multivariable models were derived (model 3). In the spirit of Sun *et al*,[25] this was done by only considering variables yielding bivariable associations with p≤0.30 as potential candidates for model 3. Forward and backward stepwise selection approaches of these candidate variables were then separately undertaken to determine the final model, using α=0.05 to define significance and p values derived from adjusted Wald's type III tests. Both approaches were employed in an effort to triangulate the results, or reveal discrepancies between models. Spearman's correlation coefficients were used to identify potential multicollinearity issues between the considered predictor variables.

The ability of the variables to predict modern contraceptive use in the final women and men's models was determined by a 10-fold cross-validated area under (AUC) the receiver operating characteristic (ROC) curve. An ROC curve provides a standardised way of evaluating the ability of a continuous marker to predict a binary outcome, and plots the true positive rate (sensitivity) against a function of the false positive rate (1-specificity) at various levels of the marker. AUC is frequently employed as summary measure of a model's predictive accuracy.[26] Adopting the recommendations of Hosmer and Lemeshow, an AUC of 0.5 suggests no discrimination, 0.7–0.8 is considered acceptable, 0.8–0.9 is considered excellent and more than 0.9 is considered outstanding.[27] In k-fold cross validation, the dataset is randomly partitioned into k approximately equally sized subsamples (or folds). At each iteration, one fold is retained as the validation data for testing the model and estimating the AUC, while the remaining k–1 folds are used as training data for model estimation. This process is repeated k times, with each of the k folds used once as the validation data. The 'cvauroc' procedure in Stata was employed to derive and average these 10-fold AUCs, and estimate its associated 95% bias corrected CI.[28] K-fold cross validation avoids the optimistic estimates of predictive performance known to exist when the full dataset is used for both model specification and prediction assessment.

Ethical considerations

As a part of the DHS survey methodology and ethics process, informed consent is obtained from all participants prior to their participation in the survey, and the collection of information is done confidentially. Once a data request has been approved, no further ethical clearance is required for use of these data for research.

Patient and public involvement

This research was done without patient involvement. Patients were not invited to comment on the study design and were not consulted to develop patient relevant outcomes or interpret the results. Patients were not invited to contribute to the writing or editing of this document for readability or accuracy.

RESULTS

Demographic characteristics

A representative sample of 20 880 households was randomly selected for the 2016 Uganda DHS, with 19 088 eligible women and 5676 eligible men being identified. Interviews were completed with 18 506 (97.0%) women and 5336 men (94.0%). Their demographic profiles appear in table 1.

Contraceptive use among women and men—overall and bivariable relationships

Overall, 4914 (26.6%) women and 1897 (35.6%) men used a modern contraceptive method. In both the women's and men's bivariable analyses (tables 2 and 3), almost all predictor variables had notable OR effect sizes. For women, large effect sizes were seen for age, marital status and parity in particular. For men, large effect sizes were associated with education, wealth index, hearing about family planning through the media and discussing family planning with a healthcare worker.

Contraceptive use among women and men—multivariable findings

Table 2 includes the model 1, model 2 and model 3 logistic regression results for women. Compared with the bivariable results, in the demographic model (model 1), the effect size associated with parity remained large, level of education became more influential, but both age and marital status diminished. The effect sizes associated with parity and education remained largely unaltered when the proximate factors were introduced (model 2), as did the AORs for the remaining variables, suggesting negligible confounding/moderation effects in the demographic variable relationships caused by the introduced

Table 1 Distribution of demographic characteristics of participating Ugandan women (n=18 506) and men in 2016 (n=5336)

	Women	Men
	N (%$_w$)*	N (%$_w$)*
Age (years)		
15–24	8058 (43.7)	2214 (41.9)
25–34	5614 (30.2)	1477 (27.7)
≥35	4834 (26.1)	1645 (30.4)
Highest educational level		
No education	2071 (9.6)	231 (4.2)
Primary	10 893 (57.4)	3047 (55.3)
Secondary or higher	5542 (32.9)	2058 (40.6)
Marital status		
Unmarried	4738 (25.8)	2029 (39.0)
Married	11 379 (60.7)	3012 (55.4)
S/D/W†	2389 (13.5)	295 (5.6)
Number of children		
0	4901 (26.7)	2163 (41.6)
1–3	7079 (38.9)	1363 (25.9)
≥4	6526 (35.5)	1810 (32.6)
Place of residence		
Urban	4379 (26.7)	1150 (24.9)
Rural	14 127 (73.3)	4186 (75.1)
Wealth index		
Poor	7524 (35.9)	2104 (34.6)
Middle	3485 (18.7)	1049 (19.6)
Rich	7497 (45.4)	2183 (45.8)

*Weighted percentages account for the sampling weights and study design.
†Separated/divorced/widowed.

proximate variables. In developing the most parsimonious multivariable model (model 3), both forward and backward stepwise selection methods yielded the same combination of variables; see table 2. None of the significant or non-significant variables were strongly correlated with each other, so non-significance was unlikely due to multicollinearity (online supplementary table A.2). Figure 1 depicts the 10-fold ROC curves derived from the women's final multivariable model. The averaged cross-validated AUC=0.714 (95% CI 0.704 to 0.720), which represents acceptable predictive accuracy.

Table 3 gives the model 1, model 2 and model 3 logistic regression results for men. Compared with the estimated bivariate ORs, in the demographic model (model 1), the effect size associated with education and wealth index remained large, number of children became more influential, but both age and marital status diminished. The effect sizes associated with all variables remained largely unaltered when the proximate factors were introduced (model 2), suggesting negligible confounding/moderation effects in the demographic variable relationships caused by the introduced proximate variables. Both forward and backward stepwise selection for men also yielded identical parsimonious multivariable models (model 3). As before, there was little evidence of multicollinearity between candidate variables (online supplementary table A.3). Figure 1 also depicts the 10-fold ROC curves for men. Here, the averaged cross-validated AUC=0.655 (95% CI 0.636 to 0.666), which falls below the threshold considered as acceptable.

DISCUSSION

In 2016, 26.6% of Ugandan women were using modern contraception, an increase from 19.9% in 2011. This study highlights that significant predictors of contraceptive use among women and men included education, wealth index and the number of living children, with marital status, region of residence and distance to a healthcare facility being important for women, while hearing about family planning through the media and discussing family planning with a health worker being important for men.

Significant associations of individual factors such as education, parity and marital status, and socioeconomic factors such as wealth index, with modern contraceptive use among women are consistent with previous studies in Uganda.[10 29] These factors remain important predictors of contraceptive use and confirm the importance of women's education and empowerment to increasing contraceptive uptake. Parity had the largest observed effect size for women across all models, underscoring its important association with contraceptive uptake. Previous work has shown that women who have several children are more likely to use contraception to limit their number of subsequent pregnancies.[11] Non-significant factors included family planning awareness through media or discussions with a health worker, religion and getting money, and/or permission for treatment. The non-significance of these variables may imply that levels of family planning knowledge are already high among women, and issues such as contraceptive method costs are not significant in determining women's contraceptive uptake. Such changes could reflect a culmination of programme and policy successes over the last two decades, particularly in increasing knowledge about family planning, and removing the barriers of cost. Though religion has been acknowledged as a key determinant of contraceptive use in Uganda, particularly when faiths have an anticontraception stance,[19] the non-significant AORs for religion across all models may be indicative of women finding ways to subvert such religious precepts in order to manage the size and well-being of their families.

For women, the odds of modern contraceptive use were lower if distance to the nearest facility was reported as a problem. The importance of geography in accessing health clinics is often a challenge for Uganda's largely rural population due to large distances and logistical difficulties.[11 30] Community health workers, village health

Table 2 Distribution of Ugandan women's modern contraceptive use across considered potential predictor variables, together with ORs and 95% CIs for bivariable analyses, and adjusted ORs (AORs) and 95% CIs from a multivariable model containing demographic variables (model 1), a model containing demographic and proximate variables (model 2) and a parsimonious multivariable model (model 3)

			Bivariable model		Model 1		Model 2		Model 3	
	N	n ($\%_w$)*	OR (95% CI)	P value	AOR (95% CI)	P value	AOR (95% CI)	P value	AOR (95% CI)	P value
Age (years)				<0.001		<0.001		<0.001		<0.001
15–24	8058	1433 (18.3)	1 (reference)		1 (reference)		1 (reference)		1 (reference)	
25–34	5614	2007 (37.1)	2.62 (2.39 to 2.90)		1.08 (0.96 to 1.22)		1.08 (0.95 to 1.22)		1.09 (0.97 to 1.23)	
≥35	4834	1474 (31.0)	2.00 (1.81 to 2.22)		0.78 (0.67 to 0.90)		0.76 (0.66 to 0.89)		0.78 (0.68 to 0.91)	
Highest educational attainment				<0.001		<0.001		<0.001		0.001
None	2071	378 (20.6)	1 (reference)		1 (reference)		1 (reference)		1 (reference)	
Primary	10893	2871 (26.6)	1.39 (1.19 to 1.63)		1.71 (1.46 to 2.00)		1.70 (1.45 to 2.00)		1.71 (1.46 to 2.01)	
Higher	5542	1665 (30.5)	1.69 (1.44 to 1.99)		2.28 (1.92 to 2.73)		2.25 (1.87 to 2.69)		2.30 (1.92 to 2.73)	
Place of residence				<0.001		0.12		0.19		
Urban	4379	1297 (30.5)	1 (reference)		1 (reference)		1 (reference)			
Rural	14127	3617 (26.1)	0.81 (0.72 to 0.90)		0.90 (0.80 to 1.02)		0.92 (0.82 to 1.04)			
Region				<0.001		0.002		0.01		0.003
Central	4325	1332 (31.2)	1 (reference)		1 (reference)		1 (reference)		1 (reference)	
East	5039	1355 (27.1)	0.82 (0.72 to 0.93)		0.91 (0.79 to 1.05)		0.92 (0.80 to 1.06)		0.90 (0.78 to 1.03)	
North	4368	869 (20.5)	0.57 (0.49 to 0.66)		0.74 (0.63 to 0.87)		0.77 (0.65 to 0.90)		0.74 (0.64 to 0.87)	
West	4774	1358 (28.1)	0.86 (0.75 to 0.99)		0.93 (0.81 to 1.08)		0.94 (0.82 to 1.08)		0.93 (0.81 to 1.07)	
Marital status				<0.001		<0.001		<0.001		<0.001
Unmarried	4738	491 (10.7)	1 (reference)		1 (reference)		1 (reference)		1 (reference)	
Married	11379	3841 (34.8)	4.46 (3.91 to 5.09)		1.36 (1.16 to 1.59)		1.37 (1.16 to 1.61)		1.35 (1.15 to 1.58)	
S/D/W†	2389	582 (25.5)	2.87 (2.47 to 3.32)		0.87 (0.72 to 1.04)		0.88 (0.73 to 1.06)		0.87 (0.73 to 1.04)	
Religion				0.13		0.25		0.23		
Other Christian‡	8585	2357 (27.9)	1 (reference)		1 (reference)		1 (reference)			
Catholic	7552	1916 (26.4)	0.93 (0.84 to 1.02)		0.99 (0.90 to 1.09)		0.99 (0.90 to 1.08)			
Muslim	2166	595 (28.3)	1.02 (0.87 to 1.19)		0.91 (0.77 to 1.08)		0.90 (0.76 to 1.07)			
Other	203	46 (22.1)	0.73 (0.50 to 1.08)		0.72 (0.51 to 1.02)		0.73 (0.51 to 1.03)			
No of children				<0.001		<0.001		<0.001		<0.001
0	4901	343 (7.2)	1 (reference)		1 (reference)		1 (reference)		1 (reference)	
1–3	7079	2280 (33.4)	6.47 (5.57 to 7.51)		6.01 (4.98 to 7.24)		6.14 (5.09 to 7.41)		6.01 (4.99 to 7.23)	
≥4	6526	2291 (36.0)	7.25 (6.20 to 8.48)		9.06 (7.29 to 11.25)		9.41 (7.57 to 11.70)		9.06 (7.31 to 11.22)	
Wealth Index				<0.001		<0.001		<0.001		<0.001

Continued

Table 2 Continued

	N	n (%$_w$)*	Bivariable model		Model 1		Model 2		Model 3	
			OR (95% CI)	P value	AOR (95% CI)	P value	AOR (95% CI)	P value	AOR (95% CI)	P value
Poor	7524	1623 (22.7)	1 (reference)		1 (reference)		1 (reference)		1 (reference)	
Middle	3485	978 (28.2)	1.37 (1.21 to 1.54)		1.32 (1.16 to 1.50)		1.29 (1.14 to 1.47)		1.30 (1.14 to 1.48)	
Rich	7497	2313 (30.9)	1.56 (1.41 to 1.72)		1.46 (1.29 to 1.65)		1.41 (1.24 to 1.59)		1.46 (1.29 to 1.65)	
Heard about family planning through media				<0.001				0.05		
No	6004	1345 (23.3)	1 (reference)				1 (reference)			
Yes	12502	3569 (29.1)	1.36 (1.24 to 1.49)				1.10 (1.00 to 1.21)			
Discussed family planning with a health worker				<0.001				0.18		
No	7591	2062 (28.2)	1 (reference)				1 (reference)			
Yes	5161	1551 (30.9)	1.14 (1.03 to 1.25)				0.94 (0.84 to 1.05)			
Unknown	5754	1301 (23.0)	0.76 (0.69 to 0.84)				1.05 (0.95 to 1.16)			
If distance to healthcare facility is a problem				<0.001				0.03		0.006
No	11292	3122 (28.5)	1 (reference)				1 (reference)		1 (reference)	
Yes	7214	1792 (25.3)	0.85 (0.78 to 0.92)				0.89 (0.81 to 0.99)		0.88 (0.80 to 0.96)	
If getting money needed for treatment is a problem				<0.001				0.41		
No	9823	2759 (28.9)	1 (reference)				1 (reference)			
Yes	8683	2155 (25.3)	0.83 (0.77 to 0.90)				0.96 (0.88 to 1.05)			
If getting permission to seek treatment is a problem				0.01				0.59		
No	17486	4674 (27.5)	1 (reference)				1 (reference)			
Yes	1020	240 (23.5)	0.81 (0.69 to 0.95)				1.05 (0.88 to 1.26)			

*Weighted percentages account for the sampling weights and study design.
†Separated/divorced/widowed.
‡Christians excluding Catholics.

Table 3 Distribution of Ugandan men's modern contraceptive use across considered potential predictor variables, together with ORs and 95% CIs for bivariable analyses, and AORs and 95% CIs from a multivariable model containing demographic variables (model 1), a model containing demographic and proximate variables (model 2) and a parsimonious multivariable model (model 3)

			Bivariable model		Model 1		Model 2		Model 3	
	N	N ($\%_w$)*	OR (95% CI)	P value	AOR (95% CI)	P value	AOR (95% CI)	P value	AOR (95% CI)	P value
Age (years)				<0.001		0.42		0.45		
15–24	2214	674 (31.7)	1 (reference)		1 (reference)		1 (reference)			
25–34	1477	618 (40.2)	1.45 (1.23 to 1.70)		1.17 (0.92 to 1.49)		1.17 (0.92 to 1.48)			
≥35	1645	605 (37.7)	1.30 (1.10 to 1.54)		1.13 (0.84 to 1.52)		1.16 (0.87 to 1.56)			
Highest educational attainment				<0.001		<0.001		<0.001		<0.001
None	231	36 (18.2)	1 (reference)		1 (reference)		1 (reference)		1 (reference)	
Primary	3047	907 (30.0)	1.93 (1.27 to 2.92)		1.99 (1.31 to 3.03)		1.86 (1.22 to 2.82)		1.87 (1.23 to 2.85)	
Higher	2058	954 (45.7)	3.79 (2.50 to 5.76)		3.50 (2.28 to 5.40)		3.02 (1.95 to 4.66)		3.10 (2.01 to 4.78)	
Place of residence				<0.001		0.39		0.34		
Urban	1150	509 (44.0)	1 (reference)		1 (reference)		1 (reference)			
Rural	4186	1388 (33.2)	0.63 (0.54 to 0.74)		0.92 (0.76 to 1.11)		0.91 (0.75 to 1.10)			
Region				<0.001		0.15		0.05		0.03
Central	1258	538 (41.5)	1 (reference)		1 (reference)		1 (reference)		1 (reference)	
East	1450	468 (31.7)	0.65 (0.53 to 0.80)		0.80 (0.64 to 0.99)		0.78 (0.62 to 0.97)		0.76 (0.61 to 0.93)	
North	1249	409 (33.3)	0.70 (0.57 to 0.87)		0.97 (0.77 to 1.22)		0.99 (0.79 to 1.26)		0.97 (0.78 to 1.22)	
West	1379	482 (35.2)	0.77 (0.63 to 0.93)		0.93 (0.75 to 1.14)		0.91 (0.74 to 1.12)		0.89 (0.72 to 1.09)	
Marital status				0.04		0.02		0.01		0.01
Unmarried	2029	651 (33.3)	1 (reference)		1 (reference)		1 (reference)		1 (reference)	
Married	3012	1127 (37.2)	1.19 (1.02 to 1.38)		0.61 (0.42 to 0.88)		0.56 (0.38 to 0.82)		0.60 (0.42 to 0.85)	
S/D/W†	295	119 (40.1)	1.34 (0.99 to 1.80)		0.77 (0.50 to 1.18)		0.76 (0.49 to 1.16)		0.80 (0.53 to 1.21)	
Religion				0.19		0.42		0.51		
Other Christian‡	2413	890 (36.4)	1 (reference)		1 (reference)		1 (reference)			
Catholic	2201	760 (35.4)	0.96 (0.82 to 1.11)		0.97 (0.83 to 1.13)		0.97 (0.83 to 1.13)			
Muslim	644	237 (37.2)	1.03 (0.82 to 1.30)		0.95 (0.75 to 1.21)		0.97 (0.76 to 1.24)			
Other	78	10 (19.5)	0.42 (0.19 to 0.94)		0.52 (0.23 to 1.15)		0.55 (0.25 to 1.22)			
No of children				<0.001		<0.001		<0.001		<0.001
0	2163	654 (31.6)	1 (reference)		1 (reference)		1 (reference)		1 (reference)	
1–3	1363	564 (41.0)	1.50 (1.27 to 1.78)		2.12 (1.52 to 2.96)		2.03 (1.45 to 2.85)		2.14 (1.53 to 2.97)	
≥4	1810	679 (37.3)	1.29 (1.10 to 1.51)		2.13 (1.44 to 3.14)		1.99 (1.34 to 2.96)		2.15 (1.50 to 3.09)	
Wealth index				<0.001		<0.001		<0.001		<0.001

Continued

Table 3 Continued

	N	N (%$_w$)*	Bivariable model OR (95% CI)	P value	Model 1 AOR (95% CI)	P value	Model 2 AOR (95% CI)	P value	Model 3 AOR (95% CI)	P value
Poor	2104	601 (28.3)	1 (reference)		1 (reference)		1 (reference)		1 (reference)	
Middle	1049	342 (32.2)	1.20 (0.99 to 1.46)		1.13 (0.92 to 1.37)		1.10 (0.90 to 1.34)		1.10 (0.90 to 1.34)	
Rich	2183	954 (43.2)	1.93 (1.66 to 2.23)		1.44 (1.21 to 1.72)		1.39 (1.16 to 1.66)		1.44 (1.22 to 1.70)	
Heard about family planning through media				<0.001				<0.001		<0.001
No	1446	359 (25.7)	1 (reference)				1 (reference)		1 (reference)	
Yes	3890	1538 (39.4)	1.88 (1.60 to 2.21)				1.48 (1.24 to 1.76)		1.48 (1.25 to 1.77)	
Discussed family planning with a health worker				<0.001				0.001		<0.001
No	4658	1567 (34.2)	1 (reference)				1 (reference)		1 (reference)	
Yes	678	330 (48.4)	1.81 (1.50 to 2.17)				1.51 (1.22 to 1.86)		1.50 (1.22 to 1.85)	

*Weighted percentages account for the sampling weights and study design.
†Separated/divorced/widowed.
‡Christians excluding Catholics.

teams and mobile outreach clinics are often the critical first touchpoint in these settings, providing services such as family planning counselling and at times, short-term contraceptive methods.[31] These urban–rural disparities are also recognised in Uganda's Family Planning Costed Implementation Plan 2015–2020, and the sustained continuation of these efforts is crucial to ensuring that these communities are reached and their contraceptive needs are met.

Only one previous study, by Kabagenyi *et al*, has looked at individual-level factors associated specifically with men's contraceptive use in Uganda, based on DHS data from 2011.[32] Our study indicates that education, marital status, number of children and wealth index are significantly associated with male contraceptive use. Higher education also had the observed largest effect size across all models, which is suggestive of the importance of men's education in informing their contraceptive attitudes and behaviour. This novel evidence is valuable for the appropriate and effective targeting of family planning programmes and reproductive health messages, particularly given that increasing male involvement in contraceptive decisions, discussions and programme has long been a goal on the family planning agenda.[16] Furthermore, the increase in modern contraceptive use to 35.6% of Ugandan men in 2016 (from 25.2% in 2011) is encouraging, and may indicate a slow shift in attitudes and increased openness towards male participation in reproductive health.[17] Non-significant factors included place and region of residence, religion and age. For men, this may imply that contraceptive access is not constrained by geographical factors, and similar to women, religious beliefs are superseded by the practical challenges of supporting a large family. Furthermore, age may not be significant in contraceptive decisions as men's reproductive capacity tends to span over a longer period of time.

Awareness about family planning via the media or through discussions with a health worker was also associated with modern contraceptive use among men. Where media is concerned, this is in line with previous work that has shown television and radio to be effective for the dissemination of health messages,[33] and lends evidence to show that these are still relevant and appropriate channels for the distribution of health information. In interactions with health workers, women are often more likely than men to engage with a health worker due to visits to the health centre for her own or her children's health. Therefore, it is noteworthy that men who have interacted with a healthcare worker have higher odds for contraceptive use, as was also reported by Kabagenyi *et al*.[32] As family planning programmes have mainly focused on women in the past, this finding highlights an opportunity for increasing male involvement, particularly in integrated health programmes.[34]

There were notable differences in the ways specific predictor variables were associated with contraceptive use for women and men. For instance, education had a greater impact on men's contraceptive use compared

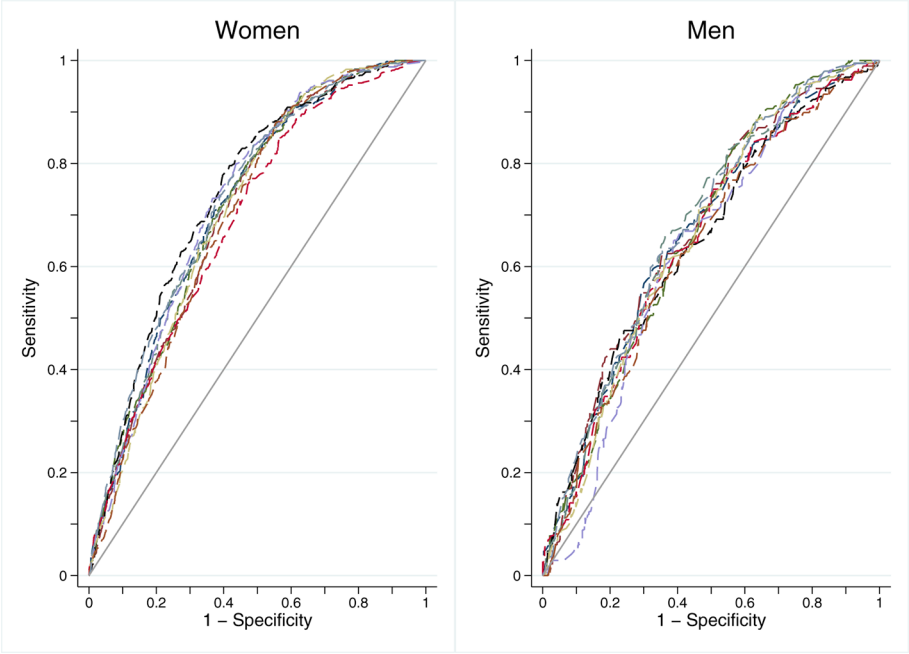

Figure 1 Tenfold cross-validation receiver operating characteristic curves for Ugandan women and men derived from the final parsimonious multivariable logistic regression models (model 3).

with women's, while parity had a more significant association with contraceptive use among women compared with men. These differences could reflect how gender roles and norms influence and motivate women's and men's contraceptive behaviour differently. For instance, the roles of childbearing and child rearing in Uganda are borne almost entirely by women,[35] and therefore women who have more children may be more motivated to use contraception to reduce the possible burden of future pregnancies. Yet for men, a large family and more children often equates to a higher status in the community,[19] and therefore their motivation to use contraception could be lower, even after several children.

The 2016 DHS sample size for women and men has been the biggest yet in Uganda, and hence the findings of this study point to key target groups and demographic factors to be considered for family planning initiatives moving forward. Important subpopulations, such as those less educated, of lower socioeconomic status and those who reside in areas outside the Central region, may still find modern contraceptive uptake and access to be a challenge. Though the goals of Uganda's Family Planning Costed Implementation Plan are formulated at a national level, these findings could inform health policy decision-makers about population groups at high risk of not using contraception, in an effort to streamline future family planning programmes and reproductive health strategies towards meeting the needs of these groups. Ultimately, it is hoped that these findings will aid in improving overall rates of contraceptive uptake among women and men, and thereby reduce the risk of unintended pregnancies, unsafe abortions and the unacceptably high maternal health burden among Ugandan women.

Strengths and limitations

This population-level study of women and men's use of modern contraception in Uganda is based on the most recently available, nationally representative data from 2016, and therefore is the most updated and accurate reflection of current contraceptive use in the country. The utilisation of a large, country-level dataset based on systematic survey methodology, together with high participant response rates, lends robustness to the results. Furthermore, the study provides a quantitative analysis of men's contraceptive use and predictors of men's contraceptive behaviour in Uganda, which has been a largely understudied area in the past. Predictor variables that were significantly associated with contraceptive use for women and men are also important in ascertaining subpopulations that would benefit from more focused efforts in terms of family planning service outreach and provision. Reaching these populations are particularly critical if the national goals of Uganda's Family Planning Costed Implementation Plan are to be achieved by 2020.

While the study has these notable strengths, it also has weaknesses. The ROC curves yielded less than adequate predictive power in the final model for men, which suggests that there may be important unmeasured factors omitted from the model, and that reliability of some self-reported variables may be relatively weak for men compared with women. Further work is recommended to examine other factors that have not been considered in this study, such as decision-making dynamics, partner characteristics, the desire for more children and the reliability of self-reporting among men. Data collected for all the variables were self-reported; hence, subject to recall bias and response bias, and the psychometric properties of the tools were not

readily available. As the study relied on secondary data analysis, it is constrained by the variables collected and their respective definitions. Lastly, while the DHS response rates were good, ranging from 94.0% to 97.0%, respondents who did not participate are likely to have lower contraceptive use likelihoods and poorer health-seeking behaviours than those who did participate.

CONCLUSION

The associations presented between modern contraceptive use and different predictor variables for women and men have substantial value in informing, tailoring and implementing future reproductive health strategies and initiatives. These results are geared towards providing a contemporary, robust evidence base, so that key population groups in need of contraceptive services can be targeted more effectively. Continued evaluation and reassessment of changes in contraceptive behaviour and uptake by way of large-scale national surveys are essential to ensuring the availability of up-to-date, empirical evidence for driving future family planning programme and policy directions, and ultimately reducing Uganda's maternal health burden.

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