



Published in final edited form as:

Afr J AIDS Res. 2021 December ; 20(4): 314–323. doi:10.2989/16085906.2021.2006727.

Barriers, benefits, and behaviour: Voluntary medical male circumcision ideation in a population-based sample of Zambian men

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Abstract

Reaching ambitious voluntary medical male circumcision (VMMC) coverage targets requires a deeper understanding of the multifaceted processes shaping men’s willingness to access VMMC. Guided by the Ideation Model for Health Communication, this population-based study identifies correlates of Zambian men’s future VMMC intentions. Multistage cluster sampling was used to identify households with adult men in 14 districts. Multivariable Poisson regression with robust standard errors modelled associations of future VMMC intent with ideational factors (e.g. perceived benefits and barriers) and sexual behaviours respectively. Forty per cent (40%) of uncircumcised men ($N = 1\,204$) expressed future VMMC intentions. In multivariable analysis, VMMC intent was associated with secondary education or higher (Adjusted Prevalence Ratio [APR] 1.30, 95% Confidence Interval [95% CI]: 1.02–1.66), perceiving VMMC to increase sexual satisfaction (APR 1.45, 95% CI: 1.11–1.89), reporting distance to services as a barrier to VMMC uptake (APR = 0.54, 95% CI: 1.27–1.87), unprotected last sex (APR 1.54, 95% CI: 1.11–2.14), and ≥ 2 sexual partners in the past 12 months (APR 1.45, 95% CI: 1.05–1.99). Being aged 45 years (vs 18–24 years: APR 0.23, 95% CI: 0.13–0.40) and perceiving that circumcision: (1) is unimportant (APR 0.71, 95% CI: 0.51–0.98); (2) is incompatible with local customs (APR 0.41, 95% CI: 0.18–0.94); or (3) reduces sexual satisfaction (APR 0.10, 95% CI: 0.02–0.62) were inversely associated with future VMMC intent. Demand-creation efforts must confront salient cognitive and social barriers to VMMC uptake, including concerns around incompatibility with local customs. Simultaneously, promotional efforts should emphasise relevant VMMC benefits

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Publisher's Disclaimer: *Disclaimer* — This article was made possible by the support of the American people through the United States Agency for International Development (USAID) under the United States President’s Emergency Plan for AIDS Relief (PEPFAR). The views in this article are those of the authors and do not necessarily represent the views of USAID, PEPFAR, or the United States Government.

¹The data used in this study are available from the senior author (EKK) upon request.

beyond HIV prevention that resonate with men (e.g. penile hygiene) without reinforcing harmful gender norms.

Keywords

health communication; HIV prevention; ideation model; sub-Saharan Africa; VMMC

Introduction

Voluntary medical male circumcision (VMMC) remains an HIV prevention priority in high-burden countries, particularly in sub-Saharan Africa. Three seminal randomised trials demonstrated VMMC's protective effect against HIV acquisition in susceptible men (Auvert et al., 2005; Bailey et al., 2007; Gray et al., 2007). Many observational studies have since reinforced VMMC's effectiveness in high-burden settings (Farley et al., 2020; Yuan et al., 2019). A mathematical modelling study estimated that 29 million additional VMMC procedures would avert over three million new HIV infections by 2025 in 14 priority countries in East and southern Africa (Njeuhmeli et al., 2011). Zambia, one such priority country, integrated VMMC into its core package of HIV prevention services for adult men in 2011 (Zambia Ministry of Health, 2012). By 2017, over 1.35 million Zambian men had accessed VMMC services, a majority of which were funded by the United States President's Emergency Plan for AIDS Relief (PEPFAR) (Davis et al., 2018). Although these efforts have expanded access to VMMC services, current estimates of male circumcision prevalence (30.9%) fall well below universal VMMC coverage thresholds (80% among HIV-uninfected men) requisite for optimal prevention efficacy at population level (World Health Organisation [WHO], 2016; Zambia Statistics Agency et al., 2019).

Zambia committed to expanding VMMC services to 400 000 additional boys and men in 2020 (PEPFAR, 2019). Achieving these ambitious targets hinges on meaningfully addressing a constellation of factors demotivating VMMC acceptance (i.e. tolerance for VMMC as an HIV prevention strategy), intent (i.e. stated willingness to be medically circumcised in the future) and uptake (i.e. undergoing medical circumcision). Widely cited barriers to VMMC willingness and uptake include: concerns about pain and post-operative complications (e.g. diminished sexual virility, penile abrasions/wounds) (Adams & Moyer, 2015; Gurman et al., 2015; Nanteza et al., 2018); VMMC's perceived incompatibility with dominant norms (Chetty-Makkan et al., 2019; Ssekubugu et al., 2013); fear of receiving an HIV diagnosis during pre-surgical screening (Andersson & Cockcroft, 2012; George et al., 2014); and perceived unimportance of VMMC or disinterest in the procedure (Hatzold et al., 2014; Macintyre et al., 2014; Westercamp et al., 2012). Although social support (from partners or peers) and perceived benefits of circumcision (e.g. heightened sexual pleasure for both partners, protection against HIV acquisition) can facilitate interest in VMMC, these facilitators may only partially disinhibit VMMC willingness in the presence of competing factors that discourage uptake (Carrasco, Wilkinson, et al., 2019). Men may support VMMC as a viable HIV prevention strategy, but many may not be interested in undergoing medical circumcision themselves (Marshall et al., 2016). Acceptance of the prevention strategy, in other words, is not a sufficient precursor or catalyst for VMMC uptake.

This gap between VMMC acceptance and willingness highlights the complex – and oftentimes conflicting – cognitive and social processes underpinning health behaviour modification. In the context of circumcision, where perceived benefits (e.g. HIV prevention, hygiene) and anticipated costs (e.g. pain, impotence) are diametrically opposed, framing men’s engagement with VMMC as a dynamic and evolving process, rather than as a static one-time choice, can identify factors that shepherd men from VMMC hesitancy to VMMC willingness and, ultimately, uptake. The Ideational Model of Communication helpfully situates individual health behaviour in a multilevel context, through which cognitive, social and environmental factors interact to support, or constrain, behavioural ideation (Health Communication Capacity Collaborative, 2015; Storey & Figueroa, 2012). The model frames ideation as an antecedent to behavioural intention and, subsequently, action. Social and behaviour change communication (SBCC), through mass media campaigns or interpersonal dialogue with peer educators, can therefore leverage these multilevel pathways to enable, confirm and reinforce proximal ideational determinants of behavioural intent and maintenance.

Given the model’s widespread application in the behavioural health sciences literature (Babalola & Vonrasek, 2005; Kincaid, 2000), it can be reasonably extended to assess ideational determinants of VMMC intent. Despite substantial attention in the qualitative literature, few studies have quantitatively interrogated relationships between the constructs articulated in the ideation model and VMMC intent or willingness (Andersson & Cockcroft, 2012; Chikutsa et al., 2015; Cook et al., 2016; Gurman et al., 2015; Hatzold et al., 2014; Jones et al., 2014; Patel et al., 2018; Redding et al., 2015). There is an even greater dearth of studies examining these associations using population-level data, which are most informative for guiding prioritisation and scale-up of VMMC services.

Emerging evidence of heightened risk for surgical complications in younger age groups motivated PEPFAR-implementing partners to discontinue VMMC services for prospective clients younger than 15 years (PEPFAR, 2019). Adolescent boys and young men (ages 10–19), however, have historically constituted a majority (approximately 70%) of VMMC clients in priority countries (Carrasco, Kaya, et al., 2019). As VMMC-implementing partners in Zambia adjust their workplans to align with new PEPFAR guidelines, a deeper understanding of the ideational context for VMMC in non-adolescent populations in particular will support VMMC demand-creation efforts tailored for adult men. This study applies constructs from the ideation model (Figure 1) to identify and quantify ideational and behavioural factors associated with VMMC intent in a nationally representative, population-based sample of Zambian men.

Materials and methods

In July and August 2016, the Zambia Community HIV Prevention Project (Z-CHPP) implemented a cross-sectional household survey to assess coverage and potential impact of existing SBCC interventions on HIV-related knowledge, behaviour and service uptake in the adult population. Two-stage sampling proportional to population size was used to select a nationally representative sample of households in 14 districts. First, geographic wards, stratified into urban and rural locales, were identified in each district. Each ward contained

a standard enumeration area (SEA), which functioned as the primary sampling unit for this survey. Each SEA consisted of an average of 130 households or the equivalent of 600 people. Six SEAs were sampled per district. Households in each SEA were then sampled systematically, with replacement, until a sample size threshold of 35 households per district was reached. Eligible adults provided written informed consent prior to study participation.

Structured, enumerator-administered interviews were conducted in selected households with an age-diverse sample of Zambian men and women, generalisable to the national adult population. Women of 15 to 49 years old and men of 18 to 59 years old providing written informed consent were eligible for participation. A participant was randomly selected from households with two or more eligible residents. The survey covered a variety of dimensions pertaining to HIV-related knowledge, attitudes and behaviours, from perceived HIV risk to uptake of HIV services (e.g. HIV testing and treatment). This study's analytic sample was restricted to men who self-reported being uncircumcised.

Measures

The primary outcome, VMMC intent, was measured from responses to the question: "Do you intend to be circumcised in the next six months?" Uncircumcised men who answered affirmatively were compared to those who denied interest in or communicated uncertainty about their future VMMC intent.

Constructs derived from the ideation model (Figure 1) were grouped into three domains: cognitive (i.e. perceived benefits, knowledge), emotional (i.e. perceived HIV susceptibility, self-efficacy to prevent HIV) and social (i.e. perceived barriers). *Perceived VMMC benefits* and *VMMC knowledge*, respectively, were measured using six statements: (1) "Circumcision reduces a man's risk of getting HIV"; (2) "Circumcision reduces a man's risk of getting sexually transmitted infections"; (3) "Circumcision makes it easier to keep the penis clean"; (4) "Circumcision increases sexual satisfaction and pleasure"; (5) "A circumcised man still must use condoms to prevent HIV"; and (6) "A circumcised man can still transmit HIV to his partner". Responses to each statement were dichotomised ("true" versus "false" or "don't know").

Perceived HIV susceptibility and *HIV avoidance self-efficacy* were each assessed using two ordinal (3-point) items: one measuring how worried participants were about contracting HIV ("not worried at all", "somewhat worried", or "extremely worried") and another addressing participants' capacity to prevent HIV infection ("not certain at all", "somewhat certain", or "extremely certain").

Lastly, uncircumcised men were prompted to respond to eight statements addressing potential *barriers to VMMC uptake*: (1) circumcision is too painful; (2) circumcision reduces sexual satisfaction; (3) the man's family does not approve or want circumcision; (4) circumcision is not customary in the man's culture; (5) the man's father is not circumcised; (6) circumcision services are too far; (7) circumcision is too expensive; and (8) circumcision is not important. Participants affirmed or denied ("yes" versus "no") whether each statement was a reason they had not yet accessed VMMC.

Past-year sexual behaviours were measured dichotomously among men self-reporting any sexual activity in the past 12 months and included the following: *unprotected last sex* (did not use a condom at last sex versus used a condom); *multiple sexual partners* (reported 2 partners versus one partner); *inconsistent condom use* (used condoms sometimes or never versus always used condoms); *sex with an unknown partner* (reported sex with a new partner whom the participant had just met versus did not); *any STI* (yes versus no); *paid for sex* (yes versus no); and *any alcohol use before sex* (yes versus no).

Sociodemographic characteristics included 10-year age groups, marital status (never versus ever married), residence type (rural versus urban) and educational attainment (none or [in]complete primary versus secondary or higher).

Analysis

Data were managed and analysed using Stata/IC 15.1 (StataCorp®). After calculating descriptive statistics for the analytic sample of uncircumcised men, Poisson regression, modified for dichotomous outcomes using robust variance estimation (approximating the log-binomial distribution) (Zou, 2004), modelled associations between ideational factors and future VMMC intent. Covariates were introduced into a multivariable model in stepwise fashion, beginning with ideational factors significantly ($p < 0.05$) associated with VMMC intent in bivariate analysis, followed by sociodemographic characteristics. Separate multivariable models were fit to identify sexual behaviours significantly associated with VMMC intent, controlling for age, marital status, residence and education. Across models, variance inflation factor scores guided removal of covariates exhibiting high collinearity with other independent variables in the models. Post-stratification design and analysis weights adjusted for selection and response probabilities. Robust standard errors accounted for hierarchical clustering of observations in SEAs and districts.

Ethics

The study was approved by the Johns Hopkins Bloomberg School of Public Health Institutional Review Board (Baltimore, USA) and ERES Converge (Lusaka, Zambia).

Results

Of the 1 769 men who completed the survey, 68% ($n = 1\ 204$) reported not being circumcised and were included in this analysis. Forty per cent (40%) of uncircumcised men expressed intent to get circumcised in the next six months. Table 1 presents weighted descriptive sample statistics. The age distribution was relatively young, with 45% of men aged ≤ 24 years. A majority lived in urban areas (70%), and over half were ever married (53%) and reported secondary education or higher (52%).

Ideation: Cognitive, emotional, and social correlates of VMMC intent

Men exhibited high awareness of both VMMC's protective benefits and limitations, with a majority correctly identifying that circumcision reduces a man's risk of acquiring HIV (71%), but acknowledging that circumcised men can still transmit HIV to their sex partners (80%) and, therefore, should use condoms to prevent HIV transmission (86%). Most

men also endorsed VMMC benefits unrelated to HIV, including prevention of sexually transmitted infections (STIs) (80%) and improved penile hygiene (85%). However, fewer than half of men perceived VMMC increased sexual satisfaction or pleasure (43%). Men's perceived susceptibility to HIV varied widely, with over a third (39%) expressing no worries about contracting HIV and 30% reporting being extremely worried about contracting HIV. Nonetheless, a majority (63%) expressed confidence in their capacity to avoid HIV infection. Anticipated pain (37%), perceived unimportance (23%) and incompatibility with local customs (12%) were the most frequently endorsed barriers to VMMC uptake.

In multivariable analysis (Table 2), men with secondary education or higher (Adjusted Prevalence Ratio [APR] 1.30, 95% Confidence Interval [95% CI]: 1.02–1.66, $p = 0.032$), who perceived VMMC increased sexual satisfaction/pleasure (APR 1.45, 95% CI: 1.11–1.89, $p = 0.006$), and who reported distance to services as a barrier to VMMC uptake (APR 1.54, 95% CI: 1.27–1.87, $p < 0.001$), were significantly more likely to express VMMC intent. By comparison, men in the oldest age quartile (45–59 years) were significantly less likely than younger men (18–24 years) to report VMMC intent (APR 0.23, 95% CI: 0.13–0.40, $p < 0.001$). Men reporting the following barriers to VMMC uptake were also significantly less likely to express future circumcision intentions: reduced sexual satisfaction (APR 0.10, 95% CI: 0.02–0.62, $p = 0.013$), incompatibility with local customs (APR 0.41, 95% CI: 0.18–0.94, $p = 0.035$) and perceived unimportance of VMMC (APR 0.71, 95% CI: 0.51–0.98, $p = 0.037$).

The following factors were significantly associated with VMMC intent only in bivariate analysis: urban residence (PR 1.37, 95% CI: 1.10–1.72, $p = 0.005$), knowledge that VMMC reduces a man's risk of STIs (PR 3.64, 95% CI: 1.85–7.16, $p < 0.001$), and perceiving improved penile hygiene as a benefit of VMMC (PR 3.44, 95% CI: 1.50–7.86, $p = 0.003$). Similarly, ever-married men, compared to never-married men, were less likely to endorse VMMC intent (PR 0.57, 95% CI: 0.43–0.77, $p < 0.001$), but this association was attenuated in multivariable analysis.

Sexual behaviour

Among sexually active uncircumcised men ($n = 1\ 046$), a majority (88%) reported inconsistent condom use with their partner(s), and 43% indicated their last sex was unprotected. Fewer men reported alcohol use before sex (33%), multiple sexual partners (29%), sex with an unknown partner (16%), paying for sex (12%), or any STI (6%) in the past year.

Figure 2 displays unadjusted and adjusted PRs of VMMC intent for sexual behaviours in the past year. Controlling for age, marital status, residence and education, men who reported unprotected last sex (APR 1.54, 95% CI: 1.11–2.14, $p = 0.009$) and multiple sex partners in the past year (APR 1.45, 95% CI: 1.05–1.99, $p = 0.023$), respectively, were significantly more likely to declare intentions to access VMMC services in the future. No other sexual behaviours were significantly associated (either positively or inversely) with VMMC intent.

Discussion

The results from this study, summarised in Table 3, indicate that knowledge about the benefits of VMMC is high, with more than 70% of respondents accurately demonstrating awareness of VMMC's HIV prevention efficacy. Importantly, most surveyed men acknowledged that circumcised men can still transmit HIV to a sex partner and, therefore, condom use was still necessary for HIV prevention following circumcision. These results suggest that there is a strong foundation of knowledge upon which to motivate and build cues to action for VMMC uptake. Although accurate information about VMMC is reaching large numbers of men, as findings from this study suggest, this knowledge is likely insufficient for motivating VMMC willingness. Contrary to what was hypothesised, accurate knowledge of VMMC was not significantly associated with VMMC intent. Of note, VMMC information is not only disseminated for demand-creation purposes, but also to ensure men who access VMMC services fully understand the benefits and risks of the procedure. Thus, provision of accurate VMMC information should complement long-standing messages promoting hallmark HIV prevention tools like condoms.

In addition to VMMC knowledge, two other constructs derived from the ideation model that were significantly associated with VMMC intent were perceived benefits and barriers. Salient barriers to VMMC uptake among Zambian men, many of which have been discussed in other studies in sub-Saharan Africa (Carrasco, Wilkinson, et al., 2019), included anticipated attenuation of sexual pleasure, incompatibility with local customs and unimportance of VMMC – of which perceived unimportance and incompatibility with local customs were most frequently endorsed. This study identified modifiable factors influencing VMMC willingness and hesitancy at population level, which could be intervened upon through evidenced-based strategies. Recruitment of satisfied older clients for VMMC promotion in Malawi and provision of medical kits and training to providers of traditional circumcision in Zimbabwe, for instance, are two evidenced-based demand-generation strategies for VMMC that leverage cognitive and social appeals to promote medical circumcision (WHO, 2020). Other interventions have been developed and piloted in priority countries to promote VMMC uptake and increase coverage (Gold et al., 2019). While the statistically significant associations identified in this study could helpfully guide VMMC demand-creation efforts for adult men, these mathematical relationships should be interpreted judiciously. For instance, perceived unimportance of VMMC, which was the most frequently cited barrier to VMMC intent in this study, warrants additional qualitative exploration, situated in the cultural context and daily lives of Zambian men and acknowledging that for some men, notably those with lower HIV risk (e.g. men in mutually monogamous partnerships), VMMC may be less relevant.

Contextualising the facilitators of VMMC intent identified in this study, chiefly perceptions of VMMC's impact on sexual arousal, is equally important, as indiscriminate promotion of these enabling factors could be more harmful than beneficial. As other studies have concluded, VMMC promotion efforts should avoid inadvertently reinforcing toxic masculinity by representing circumcision as a vehicle for heightened sexual potency (Katisi & Daniel, 2018; Kibira et al., 2017; Rudrum, 2020). This could stymie efforts to mitigate the impact of harmful gender norms on HIV-related outcomes. Programme implementers

in Zambia and elsewhere should leverage contextually relevant VMMC promotional messages that resonate emotionally with uncircumcised men – for example, messages that “masculinise” health services and empower men to “protect their loved ones” – without reinforcing gender-inequitable attitudes and norms (Fleming et al., 2017; Wiginton et al., 2020).

A surprising finding from this study was that men who reported distance to services as a barrier to VMMC uptake were significantly more likely to express VMMC intent compared to men who did not endorse distance to services as a barrier. This would suggest that among men who intend to be circumcised, structural barriers like distance and service accessibility continue to deter VMMC uptake. Despite the rapid scale-up of VMMC services in Zambia over the last decade, geographic prioritisation in the highest HIV burden districts could render VMMC inaccessible to prospective clients in areas with fewer service delivery points (Hines et al., 2017). Interventions, including provision of transportation vouchers and expansion of mobile VMMC services to low coverage settings, are acceptable and cost-effective strategies for addressing these service accessibility gaps (Atkins et al., 2020; Kennedy et al., 2020).

It is noteworthy that neither perceived susceptibility to HIV nor HIV avoidance self-efficacy emerged as significant correlates of VMMC intent. Interventions targeting perceptions of HIV risk are highly contested in the literature, given the mixed evidence surrounding the effectiveness of HIV risk communication strategies in facilitating behaviour change (Warren et al., 2018). Some studies in Kenya (Macintyre et al., 2014), Malawi (Chatsika et al., 2020), Uganda (Ssekubugu et al., 2013) and Zambia (Redding et al., 2015) have found that perceived HIV risk and the partial protection offered by VMMC are sufficient enablers of service uptake. Other studies, by comparison, have shown that other tangible social and emotional benefits, specifically penile hygiene and sexual desirability, outweigh the appeal of VMMC’s partial protection against HIV (Fleming et al., 2017; Wirth et al., 2016). Findings from this study provide additional evidence that at population level, perceived susceptibility to HIV and HIV prevention self-efficacy may be insufficient for stimulating interest in VMMC.

Finally, this study found that men reporting two types of sexual behaviours (i.e. unprotected last sex and multiple sexual partners in the past year) were more likely to express intent to access VMMC services in the future (Figure 2). This suggests that VMMC promotional messages may be better positioned to capture the attention of at-risk men and, subsequently, mitigate their HIV risk through promotion of VMMC. However, the study did not find associations of VMMC intent with other sexual behaviours, like a previous STI diagnosis or alcohol use before sex. This indicates that at population level, additional efforts are needed to sensitise men to behaviours that increase their HIV risk and to market VMMC in contextually relevant ways – for example, as a convenient, one-off and highly effective tool for mitigating their HIV risk.

Results from this study are subject to several limitations. First, given the cross-sectional design of this study, observed associations of VMMC intent with cognitive, emotional and behavioural factors derived from the ideation model lack temporality requisite for more

robust causal inferences. Nevertheless, these findings are corroborated by evidence from other studies (mentioned above) which reinforce the validity of the inferences derived from these results. Second, enumerator-administered surveys are susceptible to recall and acquiescence biases, which could render responses to survey items, particularly those eliciting sensitive information on circumcision status and sexual behaviours, inaccurate. If circumcision was overreported by respondents, for example, misclassification of circumcision status would have resulted in the inclusion of ineligible men in the analytic population, potentially overestimating or attenuating measured effect estimates. Studies have promisingly shown that self-reported circumcision is an accurate measure of actual VMMC uptake and would, therefore, be a valid approach for ascertaining circumcision status, particularly in settings where circumcision is non-normative (Jayathunge et al., 2015; Odoyo-June et al., 2018). Third, men's self-reported VMMC intentions at one point in time may not predict future service-seeking behaviours. As such, intervention recommendations pertaining only to VMMC *intent* (or expressed willingness), rather than VMMC *uptake* or *coverage*, can be inferred from this study. Lastly, because the study used the ideation model to guide covariate selection and model-building, the absence of measures corresponding to specific dimensions of ideation – for example, social norms – limits opportunities for investigating whether other unmeasured factors could facilitate VMMC intent.

Conclusions

In this population-based study, fewer than half of uncircumcised Zambian men expressed future VMMC intent, with younger and higher-educated men endorsing VMMC intent with higher frequency. Using factors derived from the ideation model, VMMC intent was significantly associated with perceived benefit of sexual satisfaction, but inversely associated with numerous cognitive and contextual barriers to VMMC uptake, including perceived unimportance and incompatibility with local customs. These findings can contribute to the design of VMMC demand-creation activities tailored for adult men. Efforts to promote VMMC should address salient barriers to uptake identified in this study, particularly concerns around incompatibility with local customs, while emphasising relevant benefits (e.g. penile hygiene, sexual desirability) beyond HIV prevention that resonate with men without reinforcing harmful gender norms. Alternative VMMC service delivery platforms, like mobile VMMC services and economic incentives (e.g. transportation vouchers) addressing accessibility barriers for prospective clients are promising solutions to increase VMMC acceptability and minimise competing constraints to uptake.

Acknowledgements —

This research was made possible through the Health Communication Capacity Collaborative (HC3) award to the Johns Hopkins Center for Communication Programs, supported by the United States Agency for International Development (USAID) under Cooperative Agreement #AID-OAA-A-12-00058.

We thank all individuals who completed the survey for their participation. We acknowledge the survey enumerators who collected the data presented in this article. Finally, we thank Arlene Phiri and Heidi O'bra at the USAID/Zambia Mission for their support of this study.

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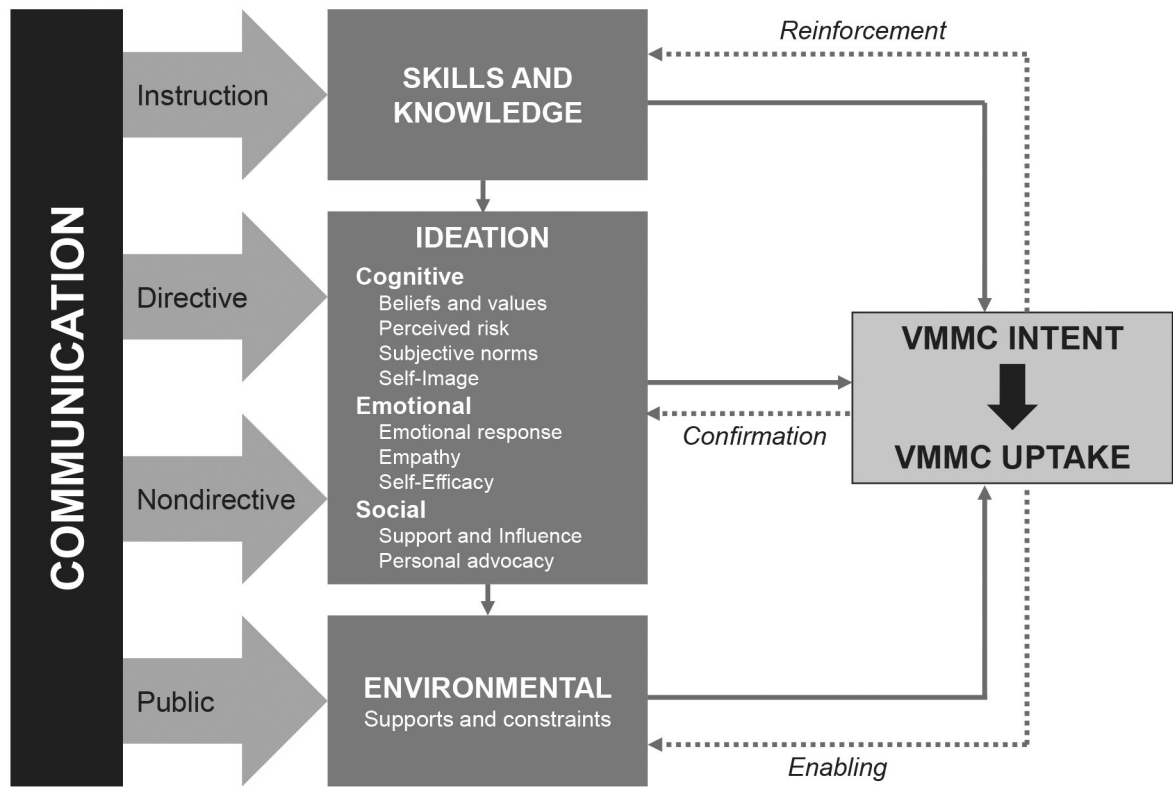


Figure 1: Adapted Ideation Model of Health Communication for identifying pathways to voluntary medical male circumcision (VMMC) intent and uptake

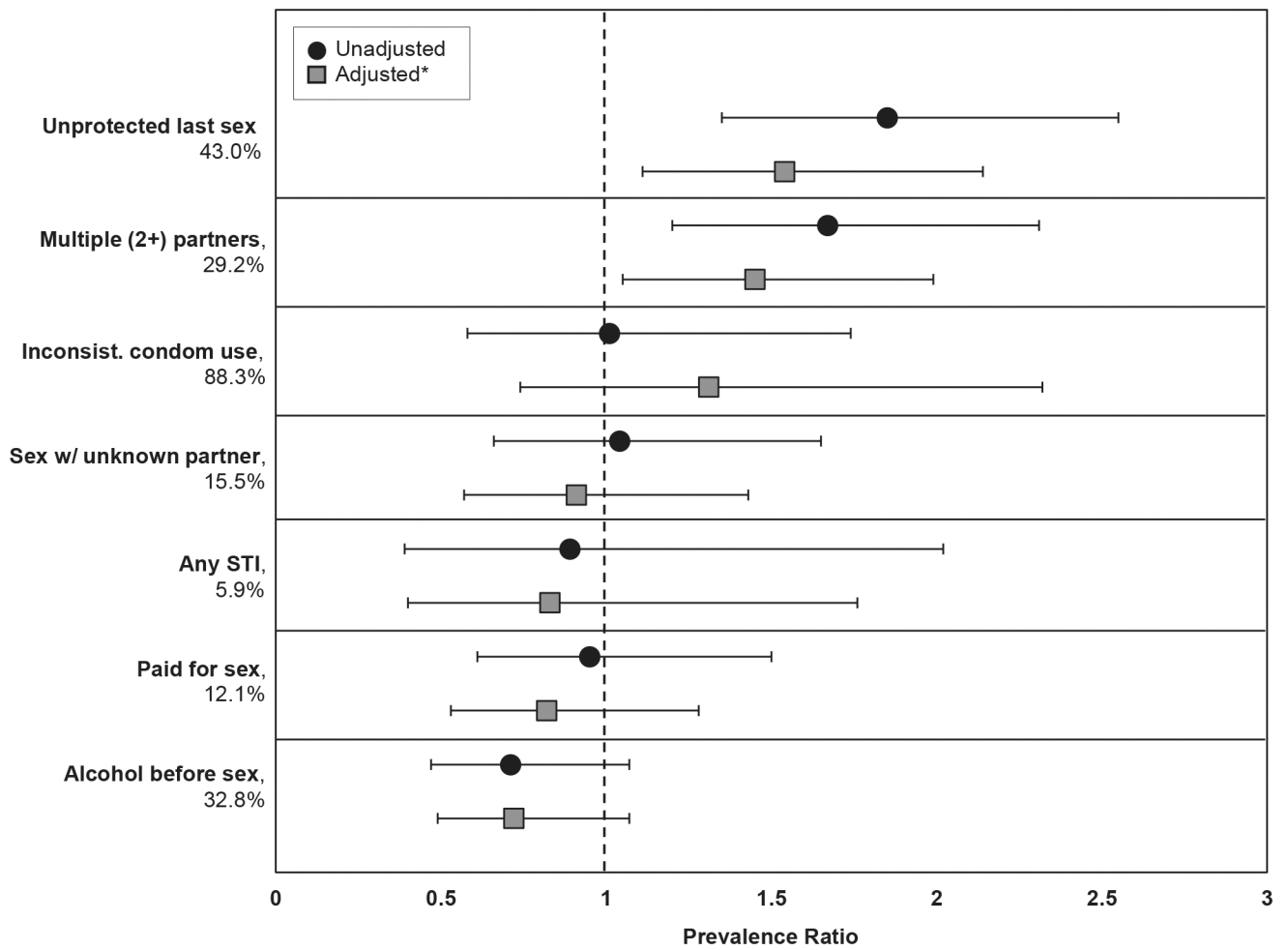


Figure 2: Forest plot of unadjusted [dots] and adjusted [squares] prevalence ratios and 95% confidence intervals [error bars] of voluntary medical male circumcision (VMMC) intent by sexual behaviours among uncircumcised sexually active men in Zambia (N= 1 046)
 *Regression coefficients adjusted for age, marital status, residence and education
 ‘Inconsist. condom use’ refers to inconsistent (sometimes or never) using condoms with any partner
 ‘Sex w/ unknown partner’ refers to any sexual encounter in the past year with a new partner whom the participant had not previously met

Table 1:Weighted descriptive sample statistics of uncircumcised Zambian men ($N= 1\ 204$)

Characteristics	Weighted proportions (%)
Demographics	
Age group	
18–24 years	45.2
25–34 years	27.0
35–44 years	16.5
45–59 years	11.3
Marital status	
Never married (single)	47.5
Ever married or in union	52.5
Residence type	
Rural	29.6
Urban	70.4
Educational attainment	
None or (in)complete primary	48.3
Secondary or higher	51.7
Cognitive factors	
Circumcision...	
Makes it easier to keep the penis clean	85.4
Reduces men's risk of STIs	80.4
Reduces men's risk of HIV acquisition	71.1
Increases sexual satisfaction/pleasure	42.5
Circumcised men...	
Still must use condoms to prevent HIV	86.0
Can still transmit HIV to a sex partner	79.9
Emotional factors	
Worried about contracting HIV ($n= 1\ 196$)	
Not worried at all	38.5
A little worried	31.3
Extremely worried	30.2
Self-efficacy to avoid getting HIV ($n= 1\ 191$)	
Not at all certain	8.6
A little certain	28.4
Extremely certain	63.0
Social factors	
Has not accessed VMMC because...	
Circumcision is too painful	36.8
It is not important	23.1
Circumcision is not customary	12.1
Services are too far	4.8

Characteristics	Weighted proportions (%)
Family doesn't approve or want	3.8
Father is not circumcised	2.8
Circumcision reduces sexual satisfaction	1.8
It is too expensive	1.0

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Unadjusted and adjusted prevalence ratios and 95% confidence intervals of voluntary medical male circumcision (VMMC) intent by demographic and ideational factors among uncircumcised Zambian men (N= 1 204)

Table 2:

Characteristics	Unadjusted		Adjusted*	
	PR (95% CI)	p-value	APR (95% CI)	p-value
Demographics				
Age group				
18–24 years	1.00	Ref.	1.00	Ref.
25–34 years	0.93 (0.68, 1.27)	0.643	1.07 (0.80, 1.43)	0.630
35–44 years	0.61 (0.40, 0.93)	0.021	0.81 (0.49, 1.34)	0.418
45–59 years	0.14 (0.08, 0.24)	<0.001	0.23 (0.13, 0.40)	<0.001
Marital status				
Never married (single)	1.00	Ref.	1.00	Ref.
Ever married or in union	0.57 (0.43, 0.77)	<0.001	0.76 (0.55, 1.04)	0.086
Residence type				
Rural	1.00	Ref.	1.00	Ref.
Urban	1.37 (1.10, 1.72)	0.005	0.96 (0.78, 1.18)	0.668
Educational attainment				
None or (in)complete primary	1.00	Ref.	1.00	Ref.
Secondary or higher	1.40 (1.04, 1.88)	0.028	1.30 (1.02, 1.66)	0.032
Cognitive factors				
Circumcision...				
Makes it easier to keep the penis clean	3.44 (1.50, 7.86)	0.003	1.48 (0.61, 3.59)	0.384
Reduces men's risk of STIs	3.64 (1.85, 7.16)	<0.001	2.05 (0.88, 4.80)	0.097
Reduces men's risk of HIV acquisition [‡]	1.67 (1.14, 2.45)	0.009		
Increases sexual satisfaction/pleasure	1.97 (1.47, 2.66)	<0.001	1.45 (1.11, 1.89)	0.006
Circumcised men...				
Still must use condoms to prevent HIV	0.81 (0.55, 1.18)	0.266		
Can still transmit HIV to a sex partner	0.80 (0.56, 1.16)	0.241		
Emotional factors				
Worried about contracting HIV (n = 1 196)				

Characteristics	Unadjusted		Adjusted*	
	PR (95% CI)	p-value	APR (95% CI)	p-value
Not worried at all	1.00	Ref.		
A little worried	1.15 (0.78, 1.69)	0.484		
Extremely worried	1.27 (0.90, 1.81)	0.177		
Self-efficacy to avoid getting HIV (<i>n</i> = 1 191)				
Not at all certain	1.00	Ref.		
A little certain	1.16 (0.58, 2.29)	0.679		
Extremely certain	1.29 (0.68, 2.47)	0.434		
Social factors				
Has not accessed VMMC because...				
Circumcision is too painful	1.14 (0.83, 1.56)	0.427		
It is not important	0.57 (0.41, 0.79)	0.001	0.71 (0.51, 0.98)	0.037
Circumcision is not customary	0.33 (0.13, 0.80)	0.015	0.41 (0.18, 0.94)	0.035
Services are too far	1.97 (1.59, 2.44)	<0.001	1.54 (1.27, 1.87)	<0.001
Family doesn't approve or want	1.20 (0.63, 2.31)	0.579		
Father is not circumcised	0.89 (0.31, 2.59)	0.837		
Circumcision reduces sexual satisfaction	0.11 (0.02, 0.58)	0.009	0.10 (0.02, 0.62)	0.013
It is too expensive	0.50 (0.09, 2.57)	0.408		

*Regression coefficients adjusted for age, marital status, residence and education

†Covariate excluded from multivariable analysis due to multicollinearity

Table 3:

Summary of significant correlates of voluntary medical male circumcision (VMMC) intent identified in multivariable analysis, by direction and magnitude of associations

Covariate	Association characteristics	
	Direction	Magnitude
Demographics		
Older age	-	✓✓✓
Secondary education or higher	+	✓
Cognitive factors		
Anticipated increases in sexual arousal	+	✓✓
Social factors		
Perceived as unimportant or unnecessary	-	✓
Perceived incompatibility with local customs	-	✓
Services are located too far away	+	✓✓✓
Fear of diminished sexual satisfaction	-	✓
Behavioural factors		
Unprotected last sex, past 12 months	+	✓✓
Multiple (2+) sexual partners, past 12 months	+	✓

Direction refers to whether the observed effect estimate was >1 (+ positive association) or < 1 (- negative association). Magnitude refers to the strength of the observed effect estimate's statistical significance: $p < 0.05 = \checkmark$, $p < 0.01 = \checkmark\checkmark$, $p < 0.001 = \checkmark\checkmark\checkmark$