2015

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Citation/Publisher Attribution
Redding, C.A., Jones, D., Zulu, R. et al. Int.J. Behav. Med. (2015) 22: 799. https://doi.org/10.1007/s12529-015-9485-z
Available at: https://doi.org/10.1007/s12529-015-9485-z

HHS Public Access

Author manuscript

Int J Behav Med. Author manuscript; available in PMC 2016 December 01.

Published in final edited form as:

Int J Behav Med. 2015 December ; 22(6): 799–806. doi:10.1007/s12529-015-9485-z.

Stages of Change for Voluntary Medical Male Circumcision and Sexual Risk Behavior in Uncircumcised Zambian Men: The Spear and Shield Project

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Abstract

Background—Dissemination and scale up of voluntary medical male circumcision (VMMC) programs is well supported by evidence that VMMC reduces HIV risk in populations with high HIV prevalence and low rates of circumcision, as is the case in Zambia.

Purpose—At both individual and population levels, it is important to understand what stages of change for VMMC are associated with, especially across cultures. This study evaluated VMMC knowledge, misinformation and stages of change for VMMC of uncircumcised men and boys (over 18 years), as well as the concurrent relationship between VMMC stages of change and sexual risk behaviors.

Method—Uncircumcised (N = 800) adult men and boys (over 18) were screened and recruited from urban community health centers in Lusaka, Zambia, where they then completed baseline surveys assessing knowledge, attitudes, HIV risk behaviors and stages of change for VMMC. A series of analyses explored cross-sectional relationships among these variables.

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Conflict of interest: C.A. Redding, D. Jones, R. Zulu, N. Chitalu, R. Cook, and S.M. Weiss report no conflicts of interest.

Ethical Standards: All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000. Written informed consent was obtained from all participants included in this study.

This article does not contain any studies with animals performed by any of the authors.

Results—VMMC was culturally acceptable in half of the sample; younger, unmarried, and more educated men were more ready to undergo VMMC. Stage of change for VMMC was also related to knowledge, and those at greater HIV risk reported greater readiness to undergo VMMC.

Conclusions—Efforts to increase VMMC uptake should address the role of perceived HIV risk, risk behaviors, readiness, accurate knowledge, cultural acceptance and understanding of the significant degree of HIV protection conferred as part of the VMMC decision making process. These results support incorporating comprehensive HIV risk reduction in VMMC promotion programs.

Keywords

Voluntary Medical Male circumcision; HIV; Zambia; Stages of Change; Readiness; Knowledge

Introduction

Medical male circumcision (VMMC) has been shown to reduce the risk of HIV among males in studies conducted in sub-Saharan Africa [1-6]. Increasing VMMC in sub-Saharan Africa has the potential to prevent up to 2 million HIV infections and 300,000 deaths over the next 10 years [7-8]. The World Health Organization has recommended countries with high HIV rates and low VMMC prevalence, which includes most countries in Eastern, Southern and Central Africa, engage in a rapid scale-up of VMMC programs [9-10].

Zambia, a Central African nation with a population of over 14 million, has a high prevalence of HIV/AIDS (19.7% in urban areas) and a low rate of VMMC (12%) among those aged 15-49 [11]. The Zambian Ministry of Health VMMC scale up plan aims to achieve 80% prevalence or 1.9 million VMMCs by 2020 [12]. Studies in other countries, e.g., Kenya, Uganda, have found VMMC to be an acceptable method of HIV risk reduction [13,14]. However, the Zambian Sexual Behavior Survey (2010) found that nationwide, over 80% of uncircumcised men expressed little interest in undergoing VMMC [15]. Factors that reduce men's willingness to undergo VMMC in traditionally non-circumcising populations have been found to include fear of pain, fear of surgical complications, fear of reduced sexual functioning [16], disappointment that VMMC provides only “partial protection” and requires continued condom use [17] and lack of cultural acceptance [18]. In contrast, improved genital hygiene, HIV prevention and low cost facilitate VMMC acceptance in Zambian men [16]. In addition, not all of those who might consider undergoing the procedure have accurate information regarding its potential benefits for both men and their partners [19].

More theory-driven constructs related to VMMC could prove useful for both research and HIV prevention purposes. Stages of change are a key construct from the Transtheoretical model that reflects intentions and readiness to change behavior and that has demonstrated both descriptive and predictive utility with other behaviors [20-23]. For these reasons, the stages of change construct was applied to VMMC and described previously in part of this sample [24]. Stages of change for consistent condom use have demonstrated predictive value previously and are relevant to HIV prevention here [25, 26]. This paper will explore these constructs in more depth in the full baseline sample.

As VMMC is scaled up, understanding relationships between VMMC attitudes, knowledge, readiness to undergo VMMC and sexual risk behaviors, grows more important. For example, misunderstanding how much HIV protection is offered by VMMC could lead to risk compensation, e.g., the reduced use of condoms for STI/HIV prevention following VMMC [26]. The first step in understanding relationships between knowledge, attitudes, readiness and risk behaviors is to examine their co-occurrence. When longitudinal data then become available, examination of rates of change over time (co-variation) and potential risk compensation, e.g., reduction in condom use, multiple partners, alcohol or drug use, becomes possible. A recent study found no evidence of risk compensation or behavioral disinhibition over 24 months in self-selected samples who did and did not undergo VMMC [27].

This study sought to quantify the relationships between VMMC knowledge, attitudes, sexual risk behaviors, and stage of change for VMMC in this large sample of uncircumcised Zambian men. It was hypothesized that men with more accurate VMMC knowledge and less misinformation would be more ready to undergo the procedure. It was also hypothesized that participants engaging in more HIV risk behaviors would be more ready to undergo VMMC.

Methods

Zambia has a population of over 14 million people, 1.8 million of whom reside in Lusaka, an urban district. Similar to other African countries, poverty and unemployment are widespread, infant mortality rates are high, and life expectancy is low, in part due to high rates of HIV.

Procedures

The Spear and Shield Project was conducted at 13 urban community health centers (CHCs) in Lusaka District, Zambia. Clinics were selected in consultation with the Lusaka Provincial Health Office based on: 1) ≥ 50 HIV voluntary counseling and testing (VCT) participants per month, 2) no trained CHC personnel currently performing circumcisions on a regular basis, 3) at least 3 health care providers available at each site for circumcision training, and 4) a minimum of 2 VCT counselors (or equivalent) available at each site for sexual risk reduction training. More details on this project and outcomes are described elsewhere [28].

Prior to study initiation, ethical approval was obtained from the University of Miami Institutional Review Board and the University of Zambia Research Ethics Committee. All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000. All participants provided written informed consent for research.

Following completion of voluntary counseling and testing (VCT), participants (N =800) were screened and recruited. Eligible men and boys were at least 18 years old, HIV-negative, uncircumcised, and had not requested or planned for VMMC at enrollment. Men

were also encouraged to invite their main sex partner to enroll in a collateral educational program described elsewhere [23].

Following screening and consent, assessments were conducted using an audio computer-assisted self-interview (ACASI) in English, Nyanja or Bemba (primary local languages) in a private carrel in study offices. Study staff demonstrated how to use the ACASI and were available to assist participants and respond to queries throughout the assessment. Baseline data from the Spear & Shield Project were included in this study.

Measures

VMMC Attitudes, Knowledge, and Misinformation—VMMC knowledge and attitudes were assessed using a measure adapted from the Uganda National Serosurvey [23,28,29]. Participants reported both methods they currently used to prevent HIV and the methods they believed were effective. Also, participants answered questions about the ability of VMMC to reduce (knowledge) or to completely negate their risk of HIV (misinformation - see below). Finally, participants indicated how culturally acceptable they perceived VMMC to be, whether or not a circumcised man still needed to use a condom for HIV prevention, and whether they had discussed VMMC with their female partner [23].

Items reflecting the idea that VMMC could help prevent HIV infection (e.g. knowledge, Circumcision of a man without HIV reduces his chance of getting HIV; 1 = Definitely False, 5 = Definitely True) or completely negate the chance of HIV infection (e.g. misinformation, A circumcised man cannot get HIV; 1 = Definitely False, 5 = Definitely True) were combined into separate scales representing VMMC knowledge (4-item α=.58) and VMMC misinformation (2-item α=.70) [23]. Both scales were coded so that higher values indicated more knowledge or misinformation respectively.

VMMC Stages of Change—Men's readiness to undergo VMMC was assessed using the stages of change [20-23, 28]. Men indicated whether they had ever thought about undergoing VMMC or were not considering undergoing it within the next 6 months (Precontemplation), were considering undergoing VMMC within the next 6 months, but had no specific plan (Contemplation), or were planning to undergo VMMC within the next 30 days (Preparation). Since this study recruited only uncircumcised men, by definition, no participants had undergone VMMC upon enrollment and thus, no participants were in Action or Maintenance stages at baseline.

Condom Stages of Change—Men's readiness to use condoms consistently when they had sex was also assessed using the stages of condom use [24,25]. Condom stages of change reflects some awareness of sexual risk for HIV. Men indicated whether they were not considering using condoms consistently when they had sex within the next 6 months (Precontemplation), were considering using condoms consistently within the next 6 months (Contemplation), or were planning to use condoms consistently within the next 30 days (Preparation). Action and Maintenance stages included those who reported consistent condom use for less than six months and more than six months, respectively [24].

Statistical Analyses

Preliminary analyses included univariate statistics (e.g., mean, standard deviation) in order to describe participant characteristics. Knowledge and misinformation scales were examined using Cronbach's coefficient alpha to assess internal consistency. In addition, bivariate associations between demographics, sexual behavior and stages of change for VMMC were examined using Spearman's correlation for continuous variables and X^2 tests for categorical variables. The first primary analysis was a multivariate regression examining the relationship between VMMC stages, knowledge, and misinformation. Knowledge and misinformation were the outcomes, and VMMC stages of change was the categorical predictor of interest. The analysis controlled for factors related to VMMC stages (i.e., age, education, and marital/cohabitation status) and included random intercepts to account for non-independence due to 1) measurements of both knowledge and misinformation on individuals and 2) clustering of participants within cohorts within clinics. A joint type-III *F* test of any difference between knowledge or misinformation between stages was first examined for significance; if significant, appropriate pairwise comparisons between stages were made, including a Bonferroni adjustment to account for multiple comparisons.

In the second primary analysis, participants' combined HIV risk behaviors were explored using latent class analysis. Risk behavior variables utilized to determine latent categories were chosen *a priori* and included condom use, lifetime STI/STD diagnosis, having multiple sexual partners, use of alcohol/drugs before sex, and having sex with a HIV-serodiscordant partner or a partner of unknown HIV status. The optimal number of categories was chosen based on the results of a bootstrapped parametric likelihood ratio test, which compares model fit between a model with *k* categories to that of one with *k*-1 categories. The results of this test were not significant for a model with three categories, indicating that a two category solution was adequate to describe HIV risk behavior; the resulting categories indicated high and low levels of risk behavior. A multinomial logistic regression was then utilized in order to determine if risk category was associated with stages of change for VMMC. Stages of change was the outcome, and HIV risk category was the predictor of interest; the model included the same covariates and random intercepts as the first primary analysis. Similar to the first analysis, a type-III *F* test of any difference in stages of change between risk categories was first examined for significance; if significant, appropriate pairwise comparisons were made. Statistical analyses were conducted using MPlus v.6.11 and SAS v. 9.3.

Results

Participants

Table 1 presents detailed descriptive statistics on participant demographic characteristics, knowledge and attitudes about VMMC, and HIV risk behaviors. Participants (N=800) ranged from 18 to 57 years old (M=27, SD= 9); just under half reported at least part time employment (n=390, 49%), and about half reported an annual income less than 500 Zambian Kwacha (∼US$100; n=423, 53%). Most participants had completed at least 12 years of education (n=526, 66%). Forty three percent (n=342) were married or cohabitating with a

partner, 39% (n=309) had children, and 44% (n=349) indicated that they were planning to have (more) children.

Mean scores on the VMMC knowledge and misinformation scales were 11.6 ± 2.5 (range = 3-16) and 5.5 ± 2.0 (range = 2-10), respectively. Fifty-six percent of male participants found VMMC to be culturally acceptable (n=446) and 56% reported discussion about undergoing VMMC with their primary sex partner (n=449); 308 men (39%) endorsed both cultural acceptance and discussion of VMMC with their partner. Only eleven percent of men (n=87) incorrectly indicated that circumcised men no longer needed to use condoms to prevent HIV.

One hundred twenty-eight participants (16%) indicated that they were not sexually active and therefore were not included in analyses of HIV risk behavior. Among the remaining 672 men, 94 (14%) reported diagnosis of at least 1 STI in their lifetime and 139 (21%) reported never using condoms and no intention to use condoms consistently in the future. Among the 644 men with a primary sexual partner, 25 (4%) were in a serodiscordant relationship and 264 (41%) reported not knowing their partner's HIV serostatus. Finally, among the 403 participants (50%) who reported having sex at least once in the past month, 158 (39%) reported having multiple sexual partners and 192 (48%) drank alcohol or used drugs before sex.

Stages of Change for VMMC

Fifty four percent of participants (n=431) indicated that they never thought about undergoing VMMC or were not considering undergoing VMMC within the next 6 months (Precontemplation stage), 34% (n=270) were considering undergoing VMMC sometime within the next six months, but had no specific plan (Contemplation stage), and 12% (n=99) reported that they were planning to undergo VMMC within the next 30 days (Preparation stage). Age was negatively correlated with stage of change for VMMC (Spearman's rho= -.08, p =.019). Table 2 shows relationships between VMMC stages and other demographic and descriptive characteristics. Men who were married or cohabitating were more likely to be in the Precontemplation stage and less likely to be in Contemplation, compared to unmarried men [$\chi^2(2) = 13.67$, $p = .001$]. VMMC stages were significantly related to education [$\chi^2(2) = 9.65$, $p = .008$], such that men with more than 12 years of education were significantly more likely to be in the Contemplation stage and less likely to be in the Precontemplation stage, compared to men with less than 12 years of education. Stages for VMMC were not related to employment, income, having children, or plans to have children. Finally, VMMC stage was not related to consistent condom use stage of change [$\chi^2(8) = 12.56$, $p = .128$].

VMMC Knowledge, Misinformation and VMMC Stages of Change

A multivariate regression analysis was used to examine the association between VMMC knowledge and misinformation and VMMC stages of change, controlling for demographic characteristics associated with VMMC stages. A joint type-III F test showed that there was at least one significant difference in mean levels of knowledge or misinformation between the stages of change for VMMC [F (2,18)= 30.65, $p < .001$]. Pairwise comparisons (with a

Bonferroni correction) showed that knowledge was higher among participants in Contemplation and Preparation as compared to those in Precontemplation, and knowledge between participants in Contemplation and Preparation did not differ. The incorrect belief that VMMC could provide complete protection against HIV (misinformation) was highest among those in Preparation, second highest among those in Precontemplation, and lowest among those in Contemplation. Figure 1 displays mean levels of knowledge and misinformation by stage of change for VMMC and *p* values for comparisons between stages.

HIV Risk Behavior and VMMC Stages of Change

Participants' combined HIV risk behaviors were explored using latent class analysis, resulting in a “high-risk” and a “low-risk” group. Table 3 describes risk behaviors characterizing high- and low-risk men. Compared to their low-risk counterparts (n = 579), high-risk participants (n = 93) were over 11 times more likely to have been previously diagnosed with an STI and over 4 times more likely to have had multiple partners in the past month. Additionally, high-risk participants were over twice as likely to have a serodiscordant primary partner or a partner of unknown serostatus, over twice as likely to have used alcohol or drugs before sex in the past month, and nearly twice as likely to report no condom use and no intention to use condoms in the future.

Stage of change for VMMC was compared between high- and low-risk participants. Controlling for demographic characteristics, risk category was significantly associated with stage of change for VMMC [$F(2,644) = 6.36$, $p = .002$]. Investigating this relationship further demonstrated that risk category did not impact the odds of being in the Contemplation stage vs. the Precontemplation stage [OR (high-risk vs. low-risk) = 0.888, 95% CI = (0.515, 1.534), Bonferonni adjusted $p = .999$]. However, high-risk status was associated with increased odds of being in the Preparation stage vs. the Precontemplation stage [OR = 2.584, 95% CI = (1.411, 4.735), adjusted $p = .007$] as well as increased odds of being in the Preparation stage vs. the Contemplation stage [OR = 2.930, 95% CI = (1.573, 5.457), adjusted $p = .002$]. Figure 2 shows the model-predicted proportion of participants in each stage of change for VMMC by risk category.

Discussion

This study examined cross-sectional relationships between men's stage of change for VMMC and demographics, VMMC knowledge, misinformation and HIV risk behaviors in the baseline sample of the Spear and Shield Project [28]. Consistent with our hypotheses, increased education, knowledge, and HIV risk behaviors were positively related to stage of change for VMMC, meaning that men with more education and knowledge, as well as higher levels of HIV risk behaviors were more ready to undergo VMMC. Men with higher levels of HIV risk behaviors were 2.5-2.9 times more likely to be in the Preparation stage for circumcision than in the Precontemplation or Contemplation stages. In this sample, readiness to undergo circumcision was also associated with younger age, having more than 12 years of education, and being unmarried. Most men perceived VMMC to be culturally acceptable and correctly understood that it did not offer complete HIV protection. Similarly,

accurate knowledge that circumcision would still require the use of condoms during sex was associated with increased readiness for VMMC.

Inconsistent with our hypotheses, misinformation about the degree of HIV protection conferred by VMMC was also highest in the Preparation stage for VMMC. In this case, "misinformation" was a "double-edged sword", which could either (albeit inappropriately) encourage or discourage consideration of VMMC. Even though most (89%) study participants did not believe that VMMC would provide complete HIV protection, this incorrect belief was still endorsed more among those in the Preparation stage. This finding suggests that VMMC promotion programs will reduce HIV risk most effectively and ethically by both: 1) clarifying the significant but not complete level of HIV protection conveyed by VMMC and 2) promoting additional HIV risk-reduction strategies, such as condom use.

These results were limited by the cross-sectional nature of the data and self-report measures. Future longitudinal studies will be able to assess whether stages of change for VMMC is predictive of actual VMMC uptake in this population, as well as whether the lack of co-occurrence between stage of change for VMMC and stage of consistent condom use found here will also be reflected in low rates of co-variation later in the trial, i.e., change over time in both behaviors. This sample of men was urban consistent with their recruitment from Lusaka, Zambia; additional research will be needed to evaluate attitudes and readiness for VMMC in more rural areas, as well as in other African countries. Finally, future examination of risk compensation longitudinally in randomized samples will also strengthen existing evidence finding no risk compensation in self-selected samples [27].

In Eastern and Southern African countries in which VMMC is rapidly scaling up, such as Zambia, these findings support public health campaigns targeting VMMC acceptability and stages of change as well as the need for *comprehensive* HIV risk reduction interventions, such as this one, that include many strategies for HIV prevention and address environment and resource-related factors, such as education, in addition to important individual-level variables [28, 30-32]. Such interventions should clarify both the advantages and limitations of *all* available HIV prevention strategies, thereby reducing misinformation that could ultimately promote risk compensation. Most country national plans to increase VMMC focus on increased availability of VMMC services, community mobilization efforts, and intensive media campaigns. However, as illustrated by the current study, "demand creation" continues to be the major challenge facing those charged with meeting national VMMC goals. Interventions are needed to enhance VMMC acceptability in addition to increasing the number of trained CHC health care providers to perform VMMCs.

Acknowledgments

This study was supported by National Institutes of Health grant number R01MH095539.

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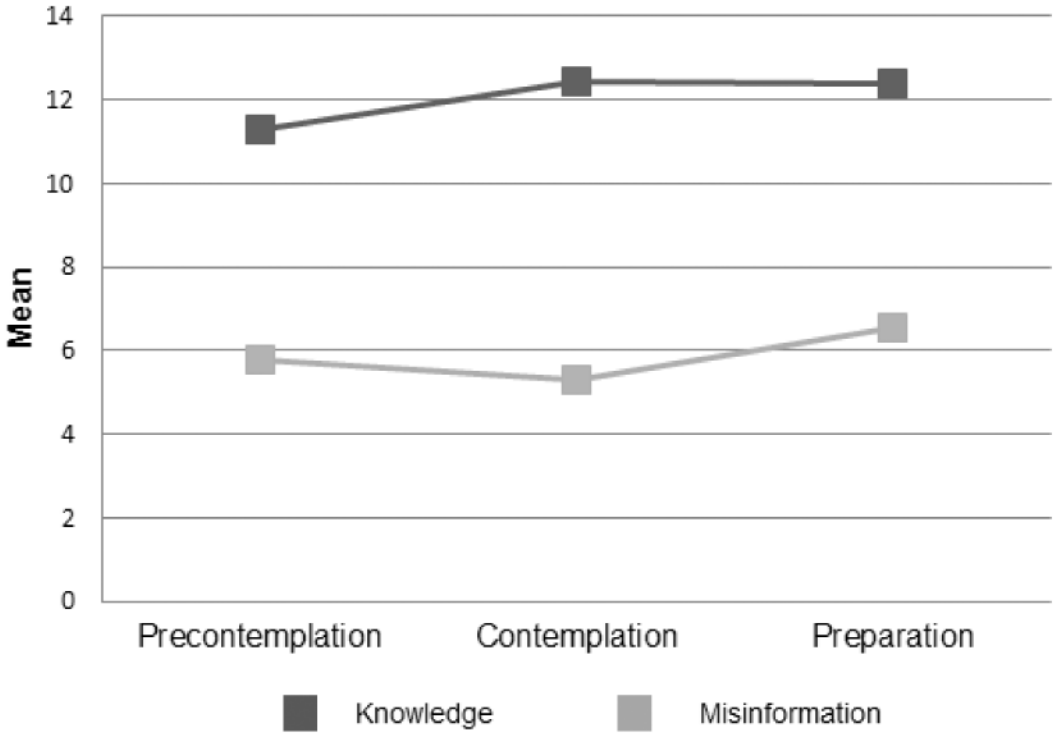

		Contemplation	Preparation
Knowledge	Precontemplation	$p < .001$	$p = .003$
	Contemplation		$p = .999$
Misinformation	Precontemplation	$p = .014$	$p = .008$
	Contemplation		$p < .001$

Note: *p* values were adjusted using a Bonferroni correction

Figure 1. Mean levels of knowledge and misinformation by Stage of Change

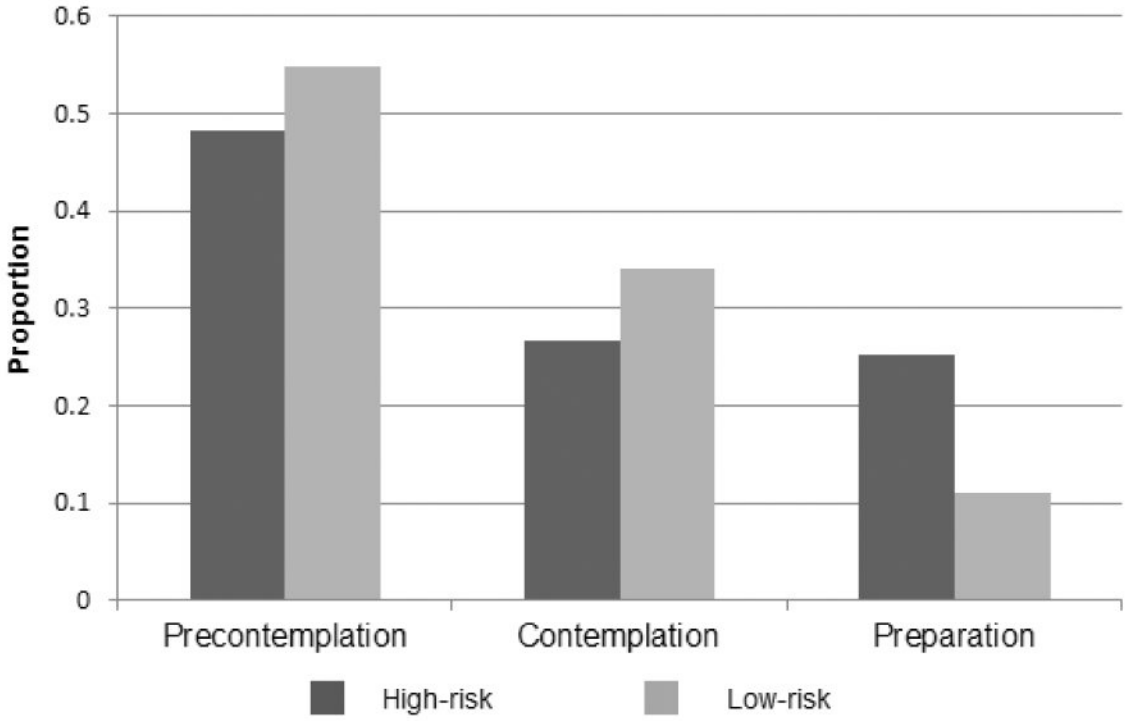

Figure 2. Model-predicted proportion of participants in each Stage of Change, by risk category

Table 1

Zambian men's baseline demographic characteristics, VMMC knowledge, attitudes, and HIV risk behaviors

Demographic Characteristic (N = 800)	**Range, M (SD)/ Number with characteristic (%)**
Age	18-57, 27 (9)
Employed at least part time	390 (49%)
Income less than 500,000 Zambian Kwacha (~$100)	423 (53%)
At least 12 years of formal education	526 (66%)
Married or cohabitating with partner	342 (43%)
Has children	309 (39%)
Has plans for (more) children	349 (44%)
VMMC Knowledge, Attitudes	**Range, M (SD)/ Number with characteristic (%)**
VMMC Knowledge	3-16, 11.6 (2.5)
VMMC Misinformation	2-10, 5.5 (2.0)
Believe that VMMC is culturally acceptable	446 (56%)
Discussed VMMC with a sex partner	449 (56%)
Believe that VMMC negates need for condom use	87 (11%)
HIV Risk Behaviors	**Number (%)**
Sex in lifetime (n = 672)	
History of STI diagnosis	94 (14%)
Condom Stage of Change	
Precontemplation	139 (21%)
Contemplation	49 (7%)
Preparation	33 (5%)
Action	274 (41%)
Maintenance	177 (26%)
Has primary sexual partner (n = 644)	
Partner HIV+ (serodiscordant)	25 (4%)
Partner unknown HIV status	264 (41%)
Sex within last month (n = 403)	
Reported multiple sexual partners	158 (39%)
Inconsistent condom use	289 (72%)
Alcohol or drugs before sex	192 (48%)

Table 2
VMMC Stages of Change By Demographic and Risk Related Characteristics

Characteristic	VMMC Stage n (%)			χ^2 (df), *p*
	Precontemplation	Contemplation	Preparation	
Employment Status				3.08 (2), .214
Employed	209 (54%)	125 (32%)	56 (14%)	
Unemployed	222 (54%)	145 (35%)	43 (10%)	
Income				5.18 (2), .075
<500 ZMK	231 (55%)	131 (31%)	61 (14%)	
≥500 ZMK	200 (53%)	139 (37%)	38 (10%)	
Marital status				13.67 (2), .001
Married or cohabitating	205 (60%)	91 (27%)	46 (13%)	
Single / not living with partner	226 (49%)	179 (39%)	53 (12%)	
Education				9.43 (3), .009
≥12 years	267 (51%)	197 (37%)	62 (12%)	
<12 years	164 (60%)	73 (27%)	37 (13%)	
Children				4.32 (2), .115
Has children	179 (58%)	91 (29%)	39 (13%)	
Does not have children	252 (51%)	179 (36%)	60 (12%)	
Plans for (more) children				2.82 (2), .243
Yes	189 (54%)	110 (32%)	50 (14%)	
No	242 (54%)	160 (35%)	49 (11%)	
Condom Stage*				12.56 (8), .128
Precontemplation	82 (59%)	36 (26%)	21 (15%)	
Contemplation	20 (41%)	22 (45%)	7 (14%)	
Preparation	21 (64%)	10 (30%)	2 (6%)	
Action	131 (48%)	106 (39%)	37 (13%)	
Maintenance	90 (51%)	67 (38%)	20 (11%)	

Note:

* in (n=672) sexually active participants

Table 3
HIV risk behaviors of "high-risk" and "low-risk" men

	High-risk	Low-risk	Relative risk (High vs. Low)
Sex in lifetime	**n = 93**	**n = 579**	
STD diagnosis	61 (66%)	33 (6%)	11.50
No intention to use condoms	32 (34%)	107 (18%)	1.86
Has primary sexual partner	**n=91**	**n=553**	
Partner serodiscordant or unknown	84 (92%)	205 (37%)	2.49
Sex within last month	**n=74**	**n=329**	
Had casual partners in past month	64 (69%)	94 (16%)	4.24
Alcohol or drugs before sex	65 (88%)	127 (39%)	2.28