

Needs Assessment and Theory-Based Promotion of Voluntary Medical Male Circumcision (VMMC) Among Male Sexually Transmitted Diseases Patients (MSTDP) in China

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Abstract Voluntary medical male circumcision (VMMC) is an evidence-based biomedical HIV prevention method. It is under-utilized in countries outside Africa, including China. The present single-arm, non-blinded test-of-concept trial was designed to promote VMMC among 179 male sexually transmitted diseases patients (MSTDP) in Shenzhen, China. It was based on behavioral health theories and results of a formative survey. At month 4, 45.5 % of the MSTDP responded positively to the intervention (19.9 % had taken up VMMC and 25.6 % intended to do so in the next 6 months). Adjusted analysis showed that cognitive variables measured at baseline (perceived self-efficacy, subjective norm and behavioral intention) significantly predicted adoption of VMMC during the 4-month follow-up period. Process evaluation involving clinicians of the STD clinics was positive. At month 6, 36.0 % of the circumcised participants used condom less frequently with their regular sex partner. We recommend scaling up the

intervention, taking prevention of risk compensation into account.

Keywords Voluntary medical male circumcision · Promotion · Risk compensation · Male STD patients · China

Introduction

Voluntary medical male circumcision (VMMC) is an evidence-based biomedical HIV intervention. It has been recommended by the World Health Organization (WHO) and the Joint United Nations Programme on HIV/AIDS (UNAIDS) for preventing HIV-1 infection among heterosexual men. The method's efficacy was established in three large-scale randomized controlled trials [1–3], and was further supported by a Cochrane systematic review [4]. It was also shown to be efficacious in preventing sexually transmitted diseases (STD), such as high-risk human papillomavirus (HR-HPV) infection [5, 6], HSV-2 infection [5], syphilis [7] and trichomonas vaginalis [8]. In addition, one study reported that VMMC was beneficial for female partners of men who had taken up VMMC [9].

Recently, VMMC has been scaled up substantially in some African countries [10, 11]. There were targets to reach 80 % coverage of VMMC in 13 prioritized African countries by the year of 2015, and hence to avert 3.36 million new HIV infections by then in the male general populations of these countries [12]. Through mass media, the ministries of health of these countries disseminated information about the HIV risk reduction effect of VMMC widely to the general public. Free VMMC programs have been offered to males in both community and hospital settings.

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According to our literature search, there is only one report published in English that described VMMC promotion among heterosexual adult male population outside Africa [13]. Uncircumcised male migrant workers from western China (e.g., Guangxi, Xinjiang, and Chongqing) were randomized into three intervention groups. In the first group, health promotion materials and on-site consultation was provided to participants simultaneously in their workplace settings. In the second and third groups, on-site consultation was provided 1 month after dissemination of health promotion materials (one session in the second group and two sessions in the third group). The prevalence of VMMC uptake over a 9-month period was 4.9, 9.3 and 14.6 %, respectively, in the first, second and third group. However, the contents of the health promotion were not described in detail. It is uncertain how the HIV risk reduction effects of VMMC were presented, and this study was neither based on a formative study nor on behavioral health theories. Furthermore, its study population was of low risk of HIV/STD infection. Hence, this study may be subject to limitations.

Setting approaches are effective in health promotion [14]. Proper settings would increase efficacy of VMMC promotion. STD clinics form an important setting that allows health workers to access groups exposed to high risk of HIV/STD infection. It is easier to promote VMMC in STD clinics than in other settings, as it is natural for STD patients to receive HIV prevention counseling from clinicians; patients may feel less stigmatized and embarrassed [15, 16]. In addition, health professionals' advices are important cue to action [17], a construct of the Health Belief Model (HBM) that is significantly associated with health related behaviors [18]. Previous studies have documented a number of effective HIV prevention interventions conducted in STD clinics [19–22].

Furthermore, theory-based interventions are more effective than non-theory-based ones [23]. The HBM [18] has been used effectively in HIV prevention [24, 25] and as the main theoretical framework for designing the present intervention. It has six constructs: perceived susceptibility, perceived severity, perceived benefit, perceived barriers, cue to action and perceived self-efficacy. As inter-personal influences are also important in influencing health-related behaviors, subjective norm which is a construct of the Theory of Planned Behavior (TPB) [26], was also used to design our intervention.

This present study was a single-arm test-of-concept trial (TOC) promoting VMMC among heterosexual male STD patients (MSTDP) attending three STD clinics in Shenzhen, China. It assessed the efficacy of a theory-based intervention that was based on the results of a formative study. In addition, factors predicting adoption of VMMC during the 4-month follow up period were identified. Those

who had taken up VMMC at month 4 were interviewed again at month 6, to record their post-circumcision experiences related to side-effects, sexual pleasure, sexual functioning and risk compensation. A very brief process evaluation was also conducted.

Methods

Overall Study Design

Based on the results of a formative survey conducted by us, a single-arm, non-blinded TOC trial was designed to promote VMMC among 179 MSTDP (94.2 % of the 190 participants being approached) in Shenzhen, China from November, 2012 to April, 2013. The eligible and consented participants completed a baseline survey and were exposed to an intervention that included watching a video clip (10 min), receiving a brief consultation provided by a counselor (10–15 min) and receiving a health promotion booklet. Evaluation was made at month 4, with 23 (12.8 %) of the 179 participants could not be contacted after being called by phone for at least five times on different days and were classified as loss to follow up. The 31 participants who had taken up VMMC during the 4-month follow-up period were interviewed by phone again at month 6. For process evaluation, the clinicians and directors of the STD clinics participating in the study were interviewed briefly and qualitatively by phone at month 6. (Figure 1).

Inclusion and Exclusion Criteria

The inclusion criteria were: (1) MSTDP attending the three STD clinics, (2) diagnosis of syphilis, genital warts, genital herpes, gonorrhea or non-gonococcal urethritis, (3) uncircumcised, (4) age of 18 years old or above, (5) no intention to leave Shenzhen in the next 12 months and (6) agreement to be followed by phone. Exclusion criteria were: (1) self-reported ever having had oral or anal sex with men; (2) known to be HIV positive; or (3) having language or cognitive impairment.

Training of the Counselors

Three training sessions (a total of 9 h) were held to train the study's counselors who were STD clinicians. Contents included evidences of VMMC in reducing risk of HIV/STD infection, detail of the intervention, as well as skills for counseling, identification of participants' stage of change, and questionnaire administration. Role plays were involved. A post-training quiz was held for assessment; ongoing supervision was exercised by the investigators. The

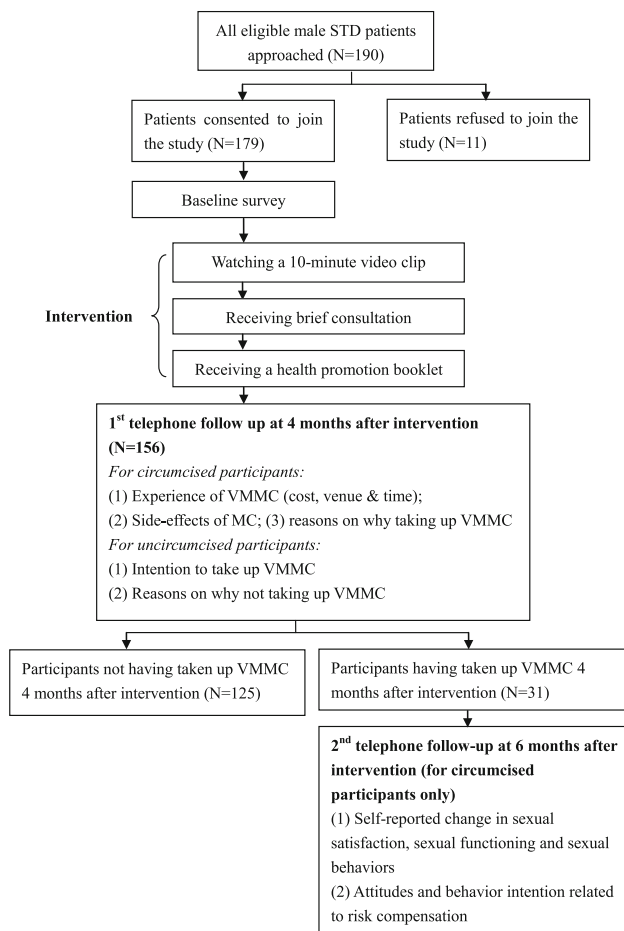


Fig. 1 Flow chart of the test-of-concept trial

research team also met with the counselors on a bi-monthly basis for problem solving, while the counselors could access the investigators by phone for questions and answers throughout the study period.

Recruitment Process

At each of the three clinics, three to five STD clinicians firstly examined prospective participants' foreskin condition. They then referred eligible ones to meet a counselor in a private room. The counselor confirmed the participants' eligibility to join the study, and assured them that refusal to join the study would not affect their right to utilize any services and they could quit anytime without being questioned. With written informed consent, the participants completed a 10-min face-to-face anonymous baseline interview and were then exposed to the intervention. A monetary compensation (50 RMB = about 8 USD) was given to them upon completion of the intervention for their time spent. Ethics approval was obtained from the Chinese University of Hong Kong.

Development of the Intervention

A formative study was firstly conducted among an independent sample of 308 MSTDP attending three STD clinics in Shenzhen, China. It identified factors that were significantly associated with intention to take up VMMC at the current market rate (about 700 RMB or 108 USD) in the next 6 months, given that it could reduce risk of HIV infection via heterosexual intercourse by 50 %. Such factors included those derived from the HBM [18]: (1) perceived severity of STD infection, (2) perceived benefits of VMMC in HIV/STD risk reduction and enhancement of sexual performance, (3) perceived side effects and embarrassment associated with VMMC (perceived barriers), (4) perceived cue to action and (5) perceived self-efficacy in taking up VMMC. In the formative study, subjective norm, which was a construct of the TPB [26], was also significantly associated with willingness to take up VMMC. The detailed results of the formative study were reported elsewhere [27].

A panel consisted of two HIV/AIDS epidemiologists, one STD clinician, one MSTDP and one journalist was then formed to develop the intervention. Several consultation meetings were made to create and to finalize the health promotion messages and materials. The contents of the intervention were also based on the findings of the formative cross-sectional survey. A message testing procedure involving two MSTDP and two STD clinicians was further conducted. Taking into account their comments, the materials were finalized.

Contents of the Intervention

In the intervention, participants firstly watched a video clip of 10 min in length alone in the waiting rooms. In the video clip, a well-known STD clinician talked about severity of STD infection and benefits of VMMC, and gave reminders about the importance of consistent condom use even after taking up VMMC. He hence provided cue to action to the participants. One MSTDP who had taken up VMMC presented a testimonial in the video clip about his positive experiences with VMMC, including improvement in sexual pleasure and sexual functioning after taking up VMMC, and social support received from his peers and female sex partner with respect to VMMC.

The counselors facilitated those who would like to take up VMMC in the next 3 months to make an appointment for check-up and surgery; he discussed with those who considered taking up VMMC about their concerns and perceived barriers, and encouraged them to make a specific plan to take up VMMC; he also reminded those who showed no intention to take up VMMC in the next 6 months about the risk of HIV/STD

infection and the benefit of taking up VMMC. According to the Trans-theoretical Model [28], the three aforementioned scenarios approximately represented the preparation, contemplation and pre-contemplation stages, respectively. Therefore, different advices had been provided by the counselors to participants according to their stage of change.

In addition, a health promotion booklet with detail description of VMMC (e.g. benefits, potential surgical complications, and a list of credible hospitals in Shenzhen that offer VMMC and telephone hotline number) was provided to the participants. All participants were encouraged to take up VMMC at a number of collaborating hospitals at the market rate (about 700 RMB or 108 USD). Hence, no subsidization was provided. Appointments could be made on site or later via the telephone hotline if desired.

The counselors were required to sign a form to record coverage of the key components of the intervention (i.e., video watching, identification of participants' stage of change, delivery of the brief consultation, as well as questions and concerns raised by the participants). The records showed that all of the aforementioned components had been delivered to all participants.

Follow-up Surveys

A telephone follow-up was conducted 4 months after participants' exposure to the intervention (month 4), to record any adoption of VMMC. In that survey, those who were yet uncircumcised were asked about their intention to take up VMMC in the next 6 months and reasons behind their decisions, while circumcised participants were asked about their experience (time, venue and cost) and side-effects related to VMMC. Another survey was conducted at month 6 to interview those participants who had taken up VMMC during the 4-month follow-up period by phone to collect information about changes with respect to sexual experiences (changes in sexual pleasure, sexual functioning, and sexual behaviors). That survey also gauged attitudes toward risk compensation, defined as increases in risky sexual behaviors after taking up VMMC. Examples of risk compensation included reduced frequency of condom use with regular female sex partners (RP), defined as their wives or regular girlfriends, and increase in frequency of sexual intercourse with female sex workers (FSW), which was defined as women who exchanged sexual services for money, or with non-regular female sex partners (NRP), which was defined as women who were neither RP nor FSW. At month 6, a brief qualitative process evaluation was conducted by phone, interviewing the directors of the three STD clinics and all other clinicians that implemented the intervention.

Outcomes

The primary outcome was participants' adoption of VMMC (at any clinic) during the 4-month follow-up period. The secondary outcome was the intention to take up VMMC in the next 6 months among those who had not yet been circumcised, which was assessed at month 4.

Other Measurements

Data on socio-demographic characteristics, HIV-related service utilization, type of STD infection, foreskin condition (e.g., normal length of foreskin: conditions that glans completely exposing or partially covered by foreskin in the absence of an erection & overly long foreskin: foreskin completely covering glans in the absence of an erection but can be retracted properly) [29], sexual behaviors (e.g. unprotected sex with RP, NRP or FSW since exhibiting STD symptoms or receiving an STD diagnosis) and cognitive variables related to VMMC that were derived from the HBM and the TPB, were collected at the baseline survey. The items are listed in Tables 1 and 2.

Statistical Analysis

Proportion of all participants adopting VMMC during the 4-month follow-up period and proportion of uncircumcised participants showing an intention to take up VMMC in the next 6 months (assessed at month 4) were presented. Adoption of VMMC during the 4-month follow-up period was used as dependent variable for subsequent logistic regression analysis. Using all background variables that were listed in Table 1 as independent variables, univariate odds ratios (ORu) predicting the dependent variable were obtained. Variables obtaining $p < 0.10$ in such univariate analysis were used as candidates for fitting a forward stepwise logistic regression model (entry $p = 0.10$; removal $p = 0.20$). Further multiple logistic regression models were fit, using cognitive variables listed in Table 2 as independent variables to estimate adjusted odds ratios (AOR) predicting the dependent variable, adjusted for significant background variables in multivariate analysis and monthly personal income. SPSS version 16.0 was used for data analysis, with p values < 0.05 taken as statistically significant.

Results

Baseline Characteristics of the Participants

The majority of the participants were younger than 40 years old (64.8 %), married or cohabiting with a female

Table 1 Background characteristics of the participants

	All participants (N = 179)	Being followed up at month 4 (N = 156)	Loss to follow up (N = 23)	<i>p</i> value
Socio-demography variables				
Age group				
18–30	28.5	30.8	13.0	
31–40	36.3	34.0	52.2	
41–50	22.9	22.4	14.6	
>50	12.3	12.8	9.1	0.218
Marital status				
Currently single	20.7	20.5	21.7	
Married or cohabited with a woman	79.3	79.5	78.3	0.892
City of usual residence				
Shenzhen	34.6	32.1	52.2	
Another city in Guangdong	23.5	24.4	17.4	
Another province in China	41.9	43.6	30.4	0.166
Highest education level attained				
Junior high or lower	24.6	23.7	30.4	
Senior high school (or equivalent)	32.4	35.3	13.0	
College	20.7	20.5	21.7	
University or above	22.3	20.5	34.8	0.154
Monthly personal income (RMB)				
<3000	21.8	19.2	39.1	
3000–4999	27.4	30.8	4.3	
5000–9999	29.6	31.4	17.4	
≥10,000	21.2	18.6	39.1	0.003
HIV-related service utilized in the last 6 months				
HIV antibody testing				
No	56.4	55.1	65.2	
Yes	43.6	44.9	34.8	0.362
STD information				
Types of current STD infection				
Syphilis	31.3	32.7	21.7	
Genital warts	20.7	20.5	21.7	
Genital herpes	5.5	5.1	8.7	
Gonorrhea/non-gonococcal urethritis (NGU)	42.5	41.7	47.8	0.701
Episodes of STD infection in the previous 3 years				
1	82.7	82.1	87.0	
≥2	17.3	17.9	13.0	0.562
Foreskin conditions				
Glans completely exposing in the absence of an erection	16.8	16.7	17.4	
Foreskin partially covering glans in the absence of an erection	29.6	28.2	39.1	
Foreskin totally covered glans in the absence of an erection, but can be retracted (overly long foreskin)	53.6	55.1	43.5	0.516
Sexual behavior in the last 6 months				
Number of regular female sex partner(s) (RP)				
0	10.6	9.6	17.4	
1	70.9	73.1	56.5	
≥2	18.4	17.3	26.1	0.252

Table 1 continued

	All participants (N = 179)	Being followed up at month 4 (N = 156)	Loss to follow up (N = 23)	<i>p</i> value
Number of non-regular female sex partner(s) (NRP)				
0	64.2	64.1	65.2	
1	17.9	17.9	17.4	
≥2	17.9	17.9	17.4	0.995
Had had patronized female sex worker (FSW)				
No	62.6	64.1	52.2	
Yes	37.4	35.9	47.8	0.270
Sexual behaviors since exhibiting STD symptoms or receiving an STD diagnosis				
Had had unprotected sex with RP				
No	65.4	64.1	73.9	
Yes	34.6	35.9	26.1	0.356
Had had unprotected sex with NRP				
No	94.4	94.2	95.7	
Yes	5.6	5.8	4.3	0.782
Had had unprotected sex with FSW				
No	96.6	96.8	95.7	
Yes	3.4	3.2	4.3	0.776

Bold value indicates statistical significance ($p < 0.05$)

partner (79.3 %), not a Shenzhen permanent resident (65.4 %) and had overly long foreskin (53.6 %). The median of monthly personal income was 5300 RMB (about 855 USD). Prevalence of their STD diagnosis was: syphilis (31.3 %), genital warts (20.7 %), genital herpes (5.5 %), and gonorrhea/non-gonococcal urethritis (42.5 %). Except for the variable on monthly personal income ($p = 0.003$, χ^2 test), no significant differences were found in other background characteristics when comparing those being followed up ($n = 156$) and those who were loss to follow up at month 4 ($n = 23$) (Table 1).

Taking Up VMMC During the 4-Month Follow-up Period and Reasons Provided

At month 4, 31 of the 156 participants being followed up (19.9 %; 95 % CI 13.6–26.2 %) had taken up VMMC during the follow up period, while 40 other participants (25.6 %; 95 % CI 18.8–32.4 %) intended to take up VMMC in the next 6 months. Therefore, 45.5 % of them responded positively to the intervention, i.e., they had either taken up VMMC or intended to do so in future. The most commonly provided reasons for taking up VMMC included the beliefs that VMMC could improve genital hygiene ($n = 10$, 32.2 %) or could prevent STD infection and re-infection ($n = 9$, 29.0 %), or having overly long foreskin ($n = 8$, 25.8 %).

Failure in Taking up VMMC During the 4-Month Follow-up Period Despite Initial Intention

A total of 68 participants indicated that they intended to take up VMMC at baseline but did not do so during the 4-month follow-up period. The major reasons for the failure included lack of time ($n = 62$, 72.9 %), concern that VMMC would affect daily life ($n = 9$, 10.6 %) and being on STD treatment ($n = 8$, 9.4 %).

Cognitions Related to HBM and TPB at Baseline

At baseline, with respect to cognitions related to the HBM, only a minority of the participants perceived a high or very high chance in contracting HIV (10.6 %) or having STD re-infections (14.5 %) in the next 12 months (perceived susceptibility), while the majority perceived that STD infection would increase their risk of HIV infection (68.7 %) or would have severe impact on their health (81.6 %) (perceived severity). About half of them perceived some benefits of VMMC, such as that it could reduce their risk of HIV and STD infection (45.3 %) or reduce their female partner's risk of contracting gynecological diseases (58.7 %). Over half of them perceived some barriers against taking up VMMC, including beliefs that VMMC would reduce sexual pleasure (72.6 %) or would result in sexual dysfunction (57.0 %). About half

Table 2 Frequency distribution of cognitive variables among participants

	All participants (N = 179)	Being followed up at month 4 (N = 156)	Loss to follow up (N = 23)	<i>p</i> value
Perceived susceptibility to HIV/STD infection				
Perceived chance of HIV infection in the next 12 months				
Very low/low/moderate	89.4	88.5	95.7	0.296
High/very high	10.6	11.5	4.3	
Perceived chance of STD re-infection in the next 12 months				
Very low/low/moderate	85.5	85.3	87.0	0.829
High/very high	14.5	14.7	13.0	
Perceived severity of STD infection				
An STD infection would increase the risk of HIV infection				
Strongly disagree/disagree/ uncertain	31.3	28.8	47.8	0.067
Agree/strongly agree	68.7	71.2	52.2	
An STD infection would have severe long term impact on one's health				
Strongly disagree/disagree/ uncertain	18.4	17.9	21.7	0.662
Agree/strongly agree	81.6	82.1	78.3	
Perceived benefit of VMMC				
VMMC could reduce the risk of HIV and STD infection				
Strongly disagree/disagree/ uncertain	54.7	55.8	47.8	0.475
Agree/strongly agree	45.3	44.2	52.2	
VMMC could reduce female sex partner's risk of contracting gynecological diseases				
Strongly disagree/disagree/ uncertain	41.3	42.3	34.8	0.494
Agree/strongly agree	58.7	57.7	65.2	
Perceived barriers of VMMC				
VMMC would reduce sexual pleasure				
Strongly disagree/disagree	27.4	28.2	21.7	0.516
Agree/strongly agree/uncertain	72.6	71.8	78.3	
VMMC would result in sexual dysfunction				
Strongly disagree/disagree	43.0	44.9	30.4	0.192
Agree/strongly agree/uncertain	57.0	55.1	69.6	
Perceived self-efficacy				
I am confident that I can take up VMMC in the next 6 months if desired				
Strongly disagree/disagree/ uncertain	58.1	58.3	56.5	0.869
Agree/strongly agree	41.9	41.7	43.5	
I have sufficient time and information required for taking up VMMC in the next 6 months				
Strongly disagree/disagree/ uncertain	46.9	48.7	34.8	0.211
Agree/strongly agree	53.1	51.3	65.2	
Subjective norm				
My peers would support me if I want to take up VMMC				
Strongly disagree/disagree/ uncertain	67.0	67.9	60.1	0.500
Agree/strongly agree	33.0	32.1	39.1	
My female sex partners would support me if I want to take up VMMC				
Strongly disagree/disagree/ uncertain	59.2	57.1	73.9	

Table 2 continued

	All participants (N = 179)	Being followed up at month 4 (N = 156)	Loss to follow up (N = 23)	<i>p</i> value
Agree/strongly agree	40.8	42.9	26.1	0.124
Behavior intention				
Do you intend to take up VMMC in the next 6 months				
No	38.5	38.5	39.1	
Yes	61.5	61.5	60.9	0.951

of them perceived self-efficacy in taking up VMMC, as respectively 41.9 % felt confident in taking up VMMC in the next 6 months if desired, and 53.1 % believed that they had sufficient time and information to take up VMMC. Regarding the subjective norm construct of the TPB, 33.0 % perceived that their peers and 40.8 % perceived that their female sex partners would support them if they would like to take up VMMC; 61.5 % showed a behavioral intention to take up VMMC in the next 6 months (Table 2).

Using Baseline Factors to Predict Adoption of VMMC During the 4-Month Follow-up Period

Monthly personal income was not significantly predicted adoption of VMMC. Adjusted for significant background variable in multivariate analysis (age group) and monthly personal income, a number of cognitive variables measured at baseline significantly predicted adoption of VMMC during the 4-month follow-up period (Table 3). Such significant baseline factors were: (1) confidence in taking up VMMC in the next 6 months if desired (AOR = 4.00, 95 % CI 1.45–9.48), a variable of perceived self-efficacy, (2) perception that they had sufficient time and information required for taking up VMMC in the next 6 months (AOR 3.29, 95 % CI 1.33–8.16), a variable of perceived self-efficacy, (3) perception that their peers (AOR = 2.93, 95 % CI 1.25–6.90) or their female sex partners (AOR = 2.53, 95 % CI 1.08–5.93) would support them if they would like to take up VMMC, two variables of subjective norm, and 4) baseline behavioral intention to take up VMMC in the next 6 months (AOR = 6.74, 95 % CI 1.90–23.94) (Table 4).

Post-surgery Experiences

In the follow-up surveys conducted at month 4, most of the 31 circumcised participants ($n = 20$, 64.5 %) reported no surgical complication. Minor complications included edema ($n = 5$), inflammation ($n = 5$), and oozing of blood ($n = 1$); about half (5/11) of those who self-reported complications of VMMC had sought medical consultation.

At month 6, 25 (80.6 %) of the circumcised participants were sexually active, while 11 (44.0 %) and 13 (52.0 %) indicated that they had improved sexual pleasure and sexual functioning as compared to their pre-surgery conditions, respectively.

With respect to risk compensation, nine (36 %) of the 25 sexually active circumcised participants reported reduced frequency of condom use with RP after taking up VMMC; 51.6 % of the 31 circumcised participants agreed that one could reduce frequency of condom use with their RP after taking up VMMC. Only one of them had had sex with NRP and none had had sex with FSW during the 6-month follow-up period; 67.7 % of them believed that it was unacceptable to increase sexual intercourse with NRP or FSW after taking up VMMC; nil intended to increase frequency of sex intercourse with NRP or FSW in the future.

Brief Process Evaluation

The brief qualitative telephone interviews conducted at month 6 indicated that all the three counselors and the three directors of the STD clinics were satisfied with the implementation of the intervention, and were willing to continue promoting VMMC at their clinics in the future. One counselor said:

“I am willing to do it in future, it’s good. I think health education on VMMC is far from enough in China. Nobody is giving accurate information to the patients.”

All the three directors supported translating VMMC promotion into a routine service. One of them said:

“In our clinic, I think it is feasible. I do not think addition of this service would affect the daily workload of our clinic”

All the 12 clinicians indicated that the health promotion on VMMC concurred with their routine services and had not increased their workload. All of them were hence willing to implement similar services in the future. One of them stated:

Table 3 Baseline background variables predicting VMMC uptake during the follow up period

	Row %	ORu (95 % CI)	ORm (95 % CI)
Socio-demography variables			
Age group			
>40	26.7	1.0	1.0
18–40	7.3	0.22 (0.07–0.65)**	0.22 (0.07–0.65)**
Marital status			
Currently single	25.0	1.0	
Married or cohabited with a woman	18.5	0.68 (0.27–1.71)	–
City of usual residence			
Shenzhen	14.0	1.0	
Another city in Guangdong	23.7	1.91 (0.64–5.69)	
Another province in China	22.1	1.74 (0.65–4.65)	–
Highest education level attained			
Junior high or lower	18.9	1.0	
Senior high school (or equivalent)	23.6	1.33 (0.47–3.72)	
College	28.1	1.67 (0.54–5.18)	
University or above	6.3	0.29 (0.06–1.49)	–
Monthly personal income (RMB)			
<3000	20.0	1.0	
3000–4999	27.1	1.49 (0.50–4.45)	
5000–9999	18.4	0.90 (0.28–2.84)	
≥10,000	10.3	0.46 (0.10–2.05)	–
HIV-related service utilized in the last 6 months			
Had tested for HIV antibody			
No	19.8	1.0	
Yes	20.0	1.05 (0.46–2.24)	–
STD information			
Types of current STD infection			
Syphilis	9.8	1.0	
Genital warts	31.2	3.27 (1.12–9.61)*	
Genital herpes	25.0	2.28 (0.44–11.82)	
Gonorrhea/non-gonococcal urethritis (NGU)	21.5	2.16 (0.77–6.06)	NS
Episodes of STD infection in the previous 3 years			
1	19.5	1.0	
≥2	21.4	1.12 (0.41–3.06)	–
Foreskin conditions			
Glans completely exposing in the absence of an erection	11.5	1.0	
Foreskin partially covering glans in the absence of an erection	20.5	1.97 (0.48–8.06)	
Foreskin totally covered glans in the absence of an erection, but can be retracted (overly long foreskin)	22.1	2.17 (0.59–8.03)	–
Sexual behavior in the last 6 months			
Number of regular female sex partner(s) (RP)			
0	40.0	1.0	
1	16.7	0.30 (0.10–0.94)*	
≥2	22.2	0.43 (0.10–1.70)	NS
Number of non-regular female sex partner(s) (NRP)			
0	17.0	1.0	
1	21.4	1.33 (0.47–3.78)	
≥2	28.6	1.95 (0.74–5.16)	–

Table 3 continued

	Row %	ORu (95 % CI)	ORm (95 % CI)
Had had patronized female sex worker (FSW)			
No	19.0	1.0	
Yes	21.4	1.16 (0.52–2.62)	–
Sexual behaviors since exhibiting STD symptoms or receiving an STD diagnosis			
Had had unprotected sex with RP			
No	24.0	1.0	
Yes	12.5	0.45 (0.10–1.70) [†]	NS
Had had unprotected sex with NRP			
No	20.4	1.0	
Yes	11.1	0.49 (0.06–4.05)	–
Had had unprotected sex with FSW			
No	20.5		
Yes	0.0	NA	–

$p > 0.10$ in univariate analysis not considered in the multivariate analysis

ORu univariate odds ratios, ORm multivariate odds ratios obtained from stepwise logistic regression using background variables $p < 0.10$ in univariate analysis as candidates (entry $p < 0.10$; exclude $p > 0.20$), NS $p > 0.10$ in stepwise logistic regression, NA not applicable

[†] $p < 0.10$; * $p < 0.05$; ** $p < 0.01$

“Examining the genital condition is a routine practice of STD consultation. Referring a patient to the counselor only takes me less than three minutes. I do not think this has increased my workload”

Discussion

The interventions were effective in promoting VMMC among MSTDP as nearly one-fifth of the participants had taken up VMMC during the 4-month follow-up period, in addition to about another one-fourth of those uncircumcised participants intending to take up VMMC in the next 6 months at month 4. The overall positive response rate (either circumcised or intended to take up circumcision) was hence close to 50 %. The proportion of taking up VMMC was apparently comparable to that of the study targeting migrant workers in China (14.6 %) [13]. However, VMMC was free of charge in that study while it was charged at market price in ours. Moreover, the follow-up period of the present study was only 4 months while theirs was 9 months. As some of those who intended to take up VMMC (almost 1/4 of all the participants) at month 4 might do so in the next 5 months, the 9-month uptake rate of our participants, if ever measured, would increase further and might be higher than that of the other study.

We decided on providing the service without any subsidy based on two considerations. First, the formative cross-sectional study that was conducted to guide the design of the health promotion materials found that income level was not significantly associated with intention to take

up VMMC in the next 6 months. Second, it allows better sustainability for future implementation in resource limited settings like China as no additional funding is required and the intervention has a better chance to be integrated with routine services. In this report, we found that the median monthly personal income was 5300 RMB which was similar to that of general population in Shenzhen (about 5000 RMB). The average market rate for VMMC was about 700 RMB (about 108 USD), which was hence about 13.2 % of the median monthly personal income of the participants, and should hence be affordable for most of them. Furthermore, we pointed out in this report that monthly personal income at the baseline was also non-significant in predicting VMMC uptake during the study period. We do not know about the exact impact of offering free VMMC to this population, the uptake rate might be higher but it would be less sustainable. We acknowledged that it was a limitation of the study that we did not have another intervention arm of free VMMC due to budget constraint of the study. However, as the uptake rate of the present study was noticeable and given the above elaborations on the observed relationship between income and uptake, we recommend that future implementations of VMMC promotion should apply the same model of giving no subsidy to increase sustainability.

It is important to translate significant research findings into regular services. The results suggested that health promotion of VMMC in the STD clinic settings was highly sustainable. We have involved directors and clinicians of the STD clinics as important stakeholders since the planning stage. The implementation was smooth and

Table 4 Baseline cognitive variables predicting VMMC uptake during the follow up period

	Row %	ORu (95 % CI)	AOR (95 % CI)
Perceived susceptibility to HIV/STD infection			
Perceived chance of HIV infection in the next 12 months			
Very low/low/moderate	18.8	1.0	
High/very high	27.8	1.66 (0.54–5.06)	–
Perceived chance of STD re-infection in the next 12 months			
Very low/low/moderate	17.3	1.0	1.0
High/very high	34.8	2.55 (0.97–6.72) [†]	2.27 (0.81–6.34)
Perceived severity of STD infection			
An STD infection would increase the risk of HIV infection			
Strongly disagree/disagree/uncertain	22.2	1.0	
Agree/strongly agree	18.9	0.82 (0.35–1.91)	–
An STD infection would have severe long term impact on one's health			
Strongly disagree/disagree/uncertain	7.1	1.0	1.0
Agree/strongly agree	22.7	3.81 (0.85–17.01) [†]	3.74 (0.81–17.21) [†]
Perceived self-efficacy			
I am confident that I can take up VMMC in the next 6 months if desired			
Strongly disagree/disagree/uncertain	9.9	1.0	1.0
Agree/strongly agree	33.8	4.66 (1.98–11.00) ^{***}	4.00 (1.64–9.74) ^{**}
I have sufficient time and information required for taking up VMMC in the next 6 months			
Strongly disagree/disagree/uncertain	10.5	1.0	1.0
Agree/strongly agree	28.8	3.43 (1.43–8.25) ^{**}	3.29 (1.33–8.16) [*]
Subjective norm			
My peers would support me if I want to take up VMMC			
Strongly disagree/disagree/uncertain	13.2	1.0	1.0
Agree/strongly agree	34.0	3.39 (1.50–7.62) ^{**}	2.93 (1.25–6.90) [*]
My female sex partners would support me if I want to take up VMMC			
Strongly disagree/disagree/uncertain	12.4	1.0	1.0
Agree/strongly agree	29.9	3.02 (1.33–6.85) ^{**}	2.53 (1.08–5.93) [*]
Behavior intention			
Intend to take up VMMC in the next 6 months			
No	5.0	1.0	1.0
Yes	29.2	7.82 (2.26–27.08) ^{***}	6.74 (1.90–23.94) ^{**}

$p > 0.10$ in univariate analysis not considered in the adjusted analysis

AOR adjusted odds ratio, odds ratio adjusted by age group and monthly personal income

[†] $p < 0.10$; * $p < 0.05$; ** $p < 0.01$

concluded with routine services of STD clinics. The cost of VMMC in China is quite reasonable. The present study offered no subsidy to the participants, so that future promotion does not require additional funding in this regard. The practice increases sustainability. The setting approach saves labor cost as it does not require outreach to promote VMMC among the target population. The intervention mainly utilized an audio-visual approach, which does not require intensive labor or training. This approach has been employed effectively in many health improvement programs [19, 30, 31]. The materials that were developed for this promotion are hence reusable (e.g., the video clip), or can be produced at relatively low

cost (e.g., health promotion booklets). Furthermore, with respect to MSTDP, VMMC is a highly accessible procedure that can be performed in most of the public hospitals. Embarrassment and perceived stigma, which are often obstacles against utilization of sex-related health services [32], might have been diminished in the setting of STD clinics [15, 16].

The next step is hence to conduct a large scale implementation research project. A larger number of STD clinics with similar settings need to be involved in multiple cities both inside and outside Guangdong province. VMMC promotion should be implemented as a regular service. It would be important to collaborate with the

Center for STD Control at provincial level or national level. Cost-effectiveness analysis should also be conducted.

The planning of future implementation programs can be facilitated by the experiences of the present study. We found that younger MSTDP were more responsive to the intervention as compared to older MSTDP. Future studies are warranted to investigate whether different strategies are needed for different age groups. We also found that baseline measurements of perceived self-efficacy, subjective norm and behavioral intention significantly predicted adoption of VMMC during the 4-month follow-up period. In the future, some follow-up after the initial clinical visit may be implemented to change these cognitions. It can be in the form of SMS, smart phone application or telephone hot-line. To increase perceived self-efficacy, the logistics for booking the surgery should be flexible and simple, and online reservation may be considered. Participants should be assisted to make their personal action plan on when and where to take up VMMC, and be supported for problem solving. To improve subject norm, counseling should be provided to participants to enhance their communication skills in discussing about taking up VMMC with their female sex partners and to obtain their support. Couple-based counseling may also be provided. According to the TPB, behavioral intention would increase when perceived behavioral control, subjective norm and attitudes are improved. The follow-up therefore should also reinstate positive attitudes and remove negative attitudes related to VMMC.

Furthermore, it is important to point out that only about one-third of those having an initial intention to take up VMMC in the next 6 months indeed did so within the 4-month period. The proposed follow-up should target those showing behavioral intention as it significantly predicted adoption of VMMC. As seen, lack of time and the concern that VMMC would affect daily life were commonly given reasons for inaction. To address these issues, scheduling should be made convenient and flexible scheduling and patients should be told clearly about the expected time required for recovery. Testimonials of those who have undergone VMMC about their recovery experiences may also be useful. Ongoing STD treatment was another commonly given reason for the failure of translating intention into action. To address this issue, clinicians should remind patients about VMMC when STD treatment ends.

Furthermore, our results reminded us that promotion of VMMC needs to include prevention of risk compensation, as 36.0 % of the circumcised participants reported they used condoms less frequently with their RP after taking up VMMC. The message is an important one as risk compensation is consequential. Since our participants were

STD patients and some STD such as syphilis and genital warts can be asymptomatic but infectious after treatment, clinicians need to explain to those having taken up VMMC the high risk of transmitting STD through unprotected sex. Although no participant had increased the frequency for sexual intercourse with NRP and FSW, nor any of them indicated an intention to do so, such responses were subjected to reporting bias. However, as the results on risk compensation were based on very small numbers, future studies are warranted to understand the dynamics of risk compensation of VMMC in this study population. Post-VMMC counseling preventing risk compensation due to VMMC needs to be carefully considered in VMMC promotion programs.

This study had the strength of being supported by results of a formative study, being theory-based, and utilized setting approach. It also has some limitations. First, a single-arm TOC trial instead of a randomized controlled trial was conducted. Secondly, the participants were only recruited from three large STD clinics and did not include those seeking consultations from smaller clinics. Third, the prevention of risk compensation following VMMC was brief, due to the limited length of the intervention. Future VMMC promotion should include an essential component of risk compensation prevention. Fourth, the 4-month follow-up period was relatively short. Fifth, risk compensation was self-reported. Some risk compensation involved social desirability and reporting bias existed. Fifth, we did not record this time length of the intervention and hence cannot adjust for this variable. The length of the intervention included a 10-min session for watching the video and a consultation which lasted from 10 to 15 min, the variation was therefore only slight. It is also a limitation of this study that the sample size was only 156, as it was planned as a test-of-concept trial instead of a full implementation study, and decision of the sample size was based on consideration of resource available. Therefore, although the identified significant factors would not be subjected to Type II error, the findings on non-significant factors (e.g., city of usual residence, foreskin conditions, number of NRP, etc.) might involve inadequate statistical power. Furthermore, evaluating the intervention sessions observed by audio/video taping was considered to be the gold standard to access treatment fidelity during delivery of the intervention [33]. We however, did not audio-taped or video-taped the intervention process, as our participants were MSTDP and the studies questions included sensitive topics such as their STD and sexual behaviors. Moreover, we did not ask the participants whether they were exposed to the key components of the assigned intervention. Lastly, the brief process evaluation involving the clinicians was very brief and was conducted by phone rather than face-to-face in-depth interviews.

Conclusions

In conclusion, the theory-based and setting-based VMMC promotion targeting MSTDP showed high efficacy, as shown by proportions taking up VMMC and intention to do so. The present intervention should be scalable and sustainable, and can potentially contribute to prevention of HIV among MSTDP.

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