BMJ Open

Effectiveness of an intervention to increase uptake of voluntary medical male circumcision among men with sexually transmitted infections in Malawi: a preinterventional and postinterventional study

Mitch M Matoga ,[1,2] Evaristar Kudowa,[1] Beatrice Ndalama,[1] Naomi Bonongwe,[1] Esther Mathiya,[1] Edward Jere,[1] Blessings Kamtambe,[1] Maganizo Chagomerana,[1] Charles Chasela,[2] Sara Jewett ,[3] Mina C Hosseinipour[4]

To cite: Matoga MM, Kudowa E, Ndalama B, *et al*. Effectiveness of an intervention to increase uptake of voluntary medical male circumcision among men with sexually transmitted infections in Malawi: a preinterventional and postinterventional study. *BMJ Open* 2023;**13**:e072855. doi:10.1136/bmjopen-2023-072855

► Prepublication history for this paper is available online. To view these files, please visit the journal online (http://dx.doi.org/10.1136/bmjopen-2023-072855).

Received 15 February 2023
Accepted 03 September 2023

For numbered affiliations see end of article.

Correspondence to
Mitch M Matoga;
mmatoga@unclilongwe.org

ABSTRACT

Objective To evaluate the effect a multistrategy demand-creation and linkage intervention on voluntary medical male circumcision (VMMC) uptake, time to VMMC and predictors of VMMC uptake among men with sexually transmitted infections (STIs).

Design Pragmatic preinterventional and postinterventional quasi-experimental study combined with a prospective observational design.

Setting A public and specialised STI clinic in Lilongwe, Malawi.

Population Uncircumcised men who presented to the STI clinic.

Methods and intervention The intervention consisted of transport reimbursement ('R'), intensified health education ('I') and short-messaging services/telephonic tracing ('Te'), abbreviated (RITe). A preintervention phase was conducted at baseline while RITe was rolled-out in the intervention phase in a sequential manner called implementation blocks: 'I' only—block 1; 'I+Te'—block 2 and RITe—block 3.

Main outcome measures Primary: VMMC uptake and time to VMMC for the full intervention and for each block. Secondary: predictors of VMMC uptake.

Results A total of 2230 uncircumcised men presented to the STI clinic. The mean age was 29 years (SD±9), 58% were married/cohabiting, HIV prevalence was 6.4% and 43% had urethral discharge. Compared with standard of care (8/514, 1.6%), uptake increased by 100% during the intervention period (55/1716, 3.2%) (p=0.048). 'I' (25/731, 113%, p=0.044) and RITe (17/477, 125%, p=0.044) significantly increased VMMC uptake. The median time to VMMC was shorter during the intervention period (6 days, IQR: 0, 13) compared with standard of care (15 days, IQR: 9, 18). There was no significant incremental effect on VMMC uptake and time to VMMC between blocks. Men with genital warts were 18 times more likely to receive VMMC (adjusted relative risk=18.74, 95% CI: 2.041 to 172.453).

Conclusions Our intervention addressing barriers to VMMC improved VMMC uptake and time to VMMC among uncircumcised men with STIs, an important subpopulation for VMMC prioritisation.

Trial registration number NCT04677374.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ This study has demonstrated implementation strategies for increasing uptake of voluntary male medical circumcision among men with sexually transmitted infections in a 'real-world' setting.
⇒ To the best of our knowledge, this is the first study to evaluate time to voluntary medical male circumcision following exposure to an intervention.
⇒ To the best of our knowledge, this is the first study to report an association between genital warts and likelihood of circumcision.
⇒ Main study limitation was the short implementation period which may have impacted on the overall impact of our intervention; however, this limitation is common with most feasibility studies.
⇒ Another limitation was gaps in health facility records, despite data quality monitoring.

INTRODUCTION

With a global aim of HIV/AIDS epidemic control by 2030, voluntary medical male circumcision (VMMC) continues to be one of the priority interventions for achieving this goal.[1] Since 2007, VMMC coverage has increased in high-priority countries in eastern and southern Africa. However, VMMC uptake has remained a challenge in some countries. By 2020, high priority countries fell 40% short of the 25 million VMMC target.[2] Malawi adopted VMMC as a HIV prevention strategy in 2012.[3] Despite the rapid scale-up

of coverage in recent years, the country was 38% short of its 2 458 727 VMMC target by 2020,[3] and prevalence of circumcision (medical and traditional) remains low around 32%.[4]

In Malawi, the main determinants of circumcision uptake are religion and culture.[5] Circumcision is commoner in traditionally circumcising populations due to religion and culture such as Muslim and Yao populations, respectively.[5] Important barriers include fear of infection, bleeding, pain and complications; limited access to VMMC services; costs associated with accessing VMMC and fear of loss of income during the recovery period; being attended to by a female provider; peer influence and misconceptions/lack of knowledge.[6–8] Facilitators include perceived health benefits, specifically penile hygiene and reduced risk of HIV and sexually transmitted infection (STI) acquisition,[5] enhanced sexual performance and sexual pleasure among partners of circumcised men,[5] peer or partner pressure,[9] need for social or cultural conformity[9] and advice from health personnel.[9] Additional facilitators reported by other researchers include awareness or knowledge,[10] personal VMMC experiences,[11] and formal education.[12]

In addition to the barriers and facilitators, several associated/predictor factors of circumcision have been reported in Malawi. These include unemployment,[13] being married[13] or of younger age,[6] exposure to VMMC messages[13] and knowledge about VMMC benefits VMMC,[13] culture,[6] residing in rural areas[13] and perceived risk of HIV acquisition.[13] Some factors reported elsewhere are higher education,[10 12] belief of increased sexual performance,[10 12] having multiple partners,[12] high perceived risk of HIV/STI acquisition,[14] and high exposure to VMMC education/messages.[14]

Numerous interventions globally have increased the demand and uptake for VMMC with varying levels of success.[15 16] Successful interventions include community-based, school-based and facility-based service delivery interventions;[15] mobile and outreach VMMC services;[15] financial incentives such as food vouchers, transport vouchers, conditional cash transfers, lotteries, VMMC cost subsidies;[16] counselling or education such as group education, tailored/targeted education, individual counselling;[16] involvement of influencers such as religious and community leaders, social influencers[16] and novel delivery of information such as short-messaging services (SMS).[16] Notably, financial incentives and education or counselling are the most acceptable and effective interventions.[16] In addition, interventions that address important social, cognitive and cultural barriers and incompatibility with local customs are deemed more appropriate and acceptable.[12]

The low circumcision prevalence in Malawi highlights the need to address barriers, capitalise on facilitators and to design innovative interventions to increase VMMC uptake. In view of this, we implemented a multistrategy intervention consisting of use of transport *R*eimbursement, *I*ntensified health education and SMS/*Te*lephonic tracing (the RITe intervention) to address key barriers to VMMC uptake. Our aim was to assess the effectiveness of the RITe intervention in increasing the uptake of VMMC among men with STIs. The implementation objective was to measure the VMMC uptake and time to VMMC following implementation of the RITe intervention. The secondary objective was to evaluate predictors to VMMC uptake among the men with STIs.

METHODS

Our manuscript followed the Standards for Reporting Implementation Studies—the StaRI checklist (see attached checklist).

Study design

Details of the methodology for this study have also been published elsewhere.[17] We conducted a pragmatic preintervention and postintervention quasi-experimental study and prospectively observed men for uptake of circumcision at Bwaila STI clinic in Lilongwe, Malawi. The study had two phases. The preimplementation phase (2 months) was used to collect baseline data on uptake of VMMC during the standard of care (SOC) period. The intervention was rolled-out in the implementation phase (7 months) in a sequential and incremental manner called implementation blocks. Implementation block 1 was *I*ntensified health education (I), block 2 was *I*ntensified health education and SMS/telephonic *T*racing (IT) and block 3 was *I*ntensified health education, SMS/telephonic *T*racing and transport *Re*imbursement (RITe).

Each participant within the implementation blocks was followed for 30 days to observe if they received circumcision.

Study context and site

The study was conducted at the Bwaila District Hospital, a public secondary level health facility in Lilongwe, the capital city of Malawi. The hospital is situated in a busy central town area and is the only facility with a specialised STI clinic in Lilongwe. The STI clinic sees approximately 15 000 patient per year and is staffed by clinicians, nurses, integrated testing services assistants and counsellors. As standard practice, all patients receive group health education on HIV and STIs and are offered routine opt-out HIV testing, before receiving care for their STI. Prior to study initiation, health education on VMMC was not offered following completion of a donor-funded programme in 2020 and VMMC was not routinely offered to all men with STIs despite this being policy.

VMMC services are offered freely by the Ministry of Health as a 'walk-in' outpatient service. However, symptomatic STI patients are advised to receive circumcision after completion of treatment and resolution of symptoms. VMMC services were discontinued at Bwaila hospital during the COVID-19 pandemic and all men interested in circumcision are referred to their nearest facility. Prior to study initiation, the prevalence of circumcision was

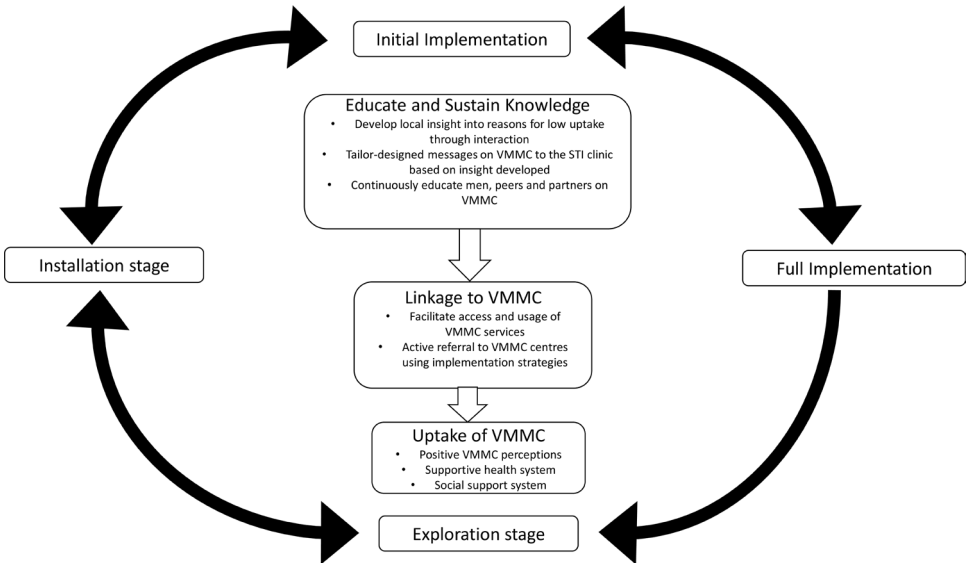

Figure 1 Conceptual framework for increasing VMMC uptake. STI, sexually transmitted infections; VMMC, voluntary medical male circumcision.

about 28% (18% traditional, 10% medical) among STI patients[18] with HIV prevalence around 13.3% at Bwaila STI clinic.[19]

The target population was (1) uncircumcised men, (2) aged ≥18 years, (3) accessing STI care, regardless of their HIV status, at the clinic during the study period. Men who were already circumcised were ineligible.

Description

Intervention

A conceptual framework (figure 1) guided the design and implementation of the intervention. The framework was designed by combining the refined compilation of implementation strategies from the Expert Recommendations for Implementing Change project,[20] the framework for demand generation,[21] the model for promotion of uptake of male circumcision[22] and the National Implementation Research Network (NIRN) stages of implementation.[23] The rationale was to increase VMMC demand by providing men with adequate and accurate knowledge about VMMC to improve their perceptions about VMMC, linking them to the nearest VMMC clinic to ensure access and motivating them by offsetting transportation cost.

Intensified health education ('I') comprised comprehensive regular group health education tailored to men with STIs followed by individual counselling by a mobiliser for interested men. The health education was intensified by adding content specific to STI patients and by increasing the daily frequency of the education (provided at least four times a day). An education guide was developed using the results from a stakeholder (policy makers, healthcare providers and men with STIs) pilot survey and literature, with guidance from the Malawi VMMC communication strategy.[3] Education sessions were administered at the STI clinic by a study trained VMMC mobiliser supported by a satisfied male and female client (VMMC champions).

Transport reimbursement ('R') was a compensation of US$10, based on the national guidelines, provided to men who were confirmed to have received circumcision during the study period. The reimbursement aimed to offset the cost of transportation to the clinic. Men returned to the STI clinic after receiving circumcision at their nearest clinic and provided documentation of circumcision which was confirmed with a physical examination by a clinician before providing the reimbursement.

SMS/telephonic (cell phone) tracing ('Te') involved short message reminders to go for circumcision sent on days 1, 3 and 7 after a STI clinic visit, followed by a phone call at day 14 for those who remained uncircumcised. The SMS messages were sent by the VMMC mobiliser to men who expressed interest in VMMC and the content read; *you are being reminded to go to your nearest clinic to receive circumcision.* The VMMC mobiliser tracked messages sent and delivered but delivery reports were not compiled.

Implementation and procedures

Preimplementation (SOC block)

The SOC block consisted of the exploration and installation NIRN stages. During these stages, we planned and created readiness for implementation and collected baseline data on circumcision uptake. Exploration included identification of one VMMC mobiliser and two VMMC champions among satisfied VMMC clients. Key stakeholders (VMMC providers, programme implementers and policy makers) were briefed on the study through consultative meetings. The installation stage was used to prepare study tools, train the VMMC mobiliser and champions and the rest of the research team on the intervention.

During the same period, we conducted formative interviews with men and healthcare workers and a pilot survey with experts to obtain an insight on factors that hinder men with STIs from receiving VMMC. The findings

guided content for the intensified health education (IHE). The mobiliser and champions were trained on the content of the IHE, interpersonal communication and relevant information about HIV and STIs. Finally, we collected baseline data on uptake of VMMC.

Implementation phase

The implementation phase consisted of the initial implementation and full implementation NIRN stages. In the initial implementation stage, we piloted IHE script and refined it, after which we rolled-out the intervention in implementation blocks as described in the study design above (full implementation stage).

We first implemented the IHE block (block 1) which lasted 5 weeks followed a 1 week wash-out period. The second was the IHE combined with SMS/telephonic reminder block (block 2) which lasted 6 weeks followed by another 1 week wash-out period. The final block was IHE combined with SMS/telephonic reminder and transport reimbursement (block 3) which lasted 6 weeks.

Study procedures

All men who attended the STI clinic received group education on circumcision during the group health talks and were offered circumcision if not already circumcised. Men as well as women interested in knowing more about circumcision received individual counselling with the VMMC mobiliser and champions. With permission from the hospital and the national ethics board (details below), we collected routine data from an electronic registry on demographics, HIV history, sexual history and current STI diagnosis from all men who visited the clinic during the study period and observed them for VMMC uptake. We collected data on age, marital status, educational level, availability of running water and electricity, condom use, number of sexual partners, whether they gave or received money, goods or favours for sex, HIV status and STI syndrome. During SMS/telephone block, we collected telephone numbers from consenting men.

The VMMC mobiliser helped each participant choose the nearest health facility with VMMC services to their home. We observed men for 30 days and collected data on circumcision. The VMMC mobiliser visited all facilities where men elected to undergo circumcision on a weekly basis to collect data on uptake of circumcision from their registries. In block 3, men who received circumcision returned to the clinic to receive transport reimbursement and their data on VMMC uptake was also collected. As part of the electronic registry project at the clinic, all participants were registered using a biometric system (fingerprinting), which helped to identify patients who came for multiple visits during the study period. All data were pulled from the registry by a data officer into a Microsoft Excel spreadsheet.

Outcomes

The primary outcome was VMMC uptake among uncircumcised men with STIs. The coprimary outcome was time to VMMC uptake among uncircumcised men with STIs. The secondary outcomes outcome was predictors to VMMC uptake among uncircumcised men with STIs.

Sample size

The study was designed to measure the uptake of VMMC among uncircumcised men with STIs. Without data on the incidence of VMMC among STI patients, our sample size was determined by the available population of men with STIs seeking care at the clinic during the study period. We observed VMMC uptake among all uncircumcised men with STIs who presented to the clinic during the implementation period. Based routine data, we had estimated that minimum of 380 uncircumcised men would visit the clinic within a month. With the 6 months project implementation period, we anticipated that a minimum of 2280 uncircumcised men would be exposed to our intervention and observed for VMMC uptake.

Analysis

We used descriptive statistics to summarise sociodemographic, sexual and clinical data by intervention block. Uptake of VMMC was calculated as a proportion of men who received VMMC divided by the total number of men who were offered/sensitised on VMMC during the study period. Uptake was calculated for each intervention block and the entire intervention period was compared with the SOC (between February and March 2021) using a test of proportion. We used the first visit for each participant during the intervention period in the analysis to avoid double counting. We estimated median time to uptake of circumcision for the intervention and compared the median time to uptake of circumcision for each block and the entire intervention using the Kruskal Wallis test. In addition, we used the Kaplan Meier estimator method to compare time to circumcision over the 30-day follow-up period. Cox proportional hazard models were used to evaluate factors associated with 'risk' of uptake of circumcision (predictors).

In the Cox proportional hazard regression, we used complete case analysis by restricting the predictor analysis to patients who had data for all the variables of interest. The risk factors of interest included age (<25 and ≥25 years), HIV status (positive, negative and unknown/discordant), education level (none, primary and secondary and >secondary), marital status (single/divorced/separated and married), electricity (yes and no), running water (yes and no), gave money, goods or favours for sex (yes and no) and STI syndrome (urethral discharge, genital ulcer disease, genital warts, balanitis and other). Some variables, that is, condom use at last sex, number of sexual partners in the last 4 weeks and received money, goods or favours for sex were excluded from the regression analyses due to insufficient sample sizes. All comparisons were conducted using a two-sided alpha of 0.05.

Patient and public statement

The Community Advisory Board (CAB) provided feedback on the development of this research, recruitment process and will advise on the methods for disseminating the study results to the public. No patients were involved in the development of research question and outcomes. Patients were involved in the design of the study by participating in a pilot survey which help informed the content of the IHE guide. Patients were not involved in the recruitment or conduct of the study. Results will be disseminated to patients through a research dissemination meeting with the CAB.

RESULTS

Demographic and clinical characteristics

A total of 2230 uncircumcised men presented to the Bwaila STI clinic to receive care for their STI during the study period. The mean age was 29 years (SD±9) and half (50%) were between 19 and 29 years. Most (58%) men were married or cohabiting with a stable partner and had secondary school education (53%). The HIV prevalence was 6.4% and the majority (96%) reported not using a condom during last sexual encounter and having one sexual partner (96%). Some (12%) men reported to giving out money, goods or favours in exchange for sex in the past 4 weeks prior to their clinic visit. The most common STI syndromic diagnoses were urethral discharge (44%) and genital ulcer disease (21%) (table 1). In the preimplementation phase (SOC), 8/514 (1.6%) of men received circumcision. Participant characteristics were similar between the SOC and intervention period.

Primary outcome

In total, 1716 uncircumcised men were sensitised on VMMC during the implementation phase. Of the 1716 uncircumcised men, 55 (3.2%) received circumcision during the intervention period. Compared with the SOC, there was a 100% increase (1.6% vs 3.4%, p=0.048) in VMMC uptake during the intervention period. The largest increase was observed during the 'RITe' block (17/477, 125%, p=0.044) followed by the 'I' block (25/731, 113%, p=0.044), but the increase during the 'I+Te' block (13/508, 63%, p=0.259) was not statistically significant (table 2). The median time to circumcision was shorter during the intervention period (6 days, IQR: 0, 13) compared with the SOC (15 days, IQR: 9, 18) (p=0.013). Stratified by intervention block, the median time was the fastest during the 'I+Te' block (3 days, IQR: 0, 6, p=0.001), followed by 'I' (6 days, IQR: 1, 9, p=0.009) and finally, 'RITe' (9 days, IQR:0, 14, p=0.095) (figure 2). During the intervention, the likelihood of receiving circumcision tended to be two times higher than the SOC period, but this difference was not statistically significant (HR=2.08, 95% CI: 0.99 to 4.37, p=0.052). The trend in likelihood of circumcision was similar when we compared between each strategy and the SOC. However, it was statistically significant for 'I' versus SOC (HR=2.23, 95% CI: 1.01 to 4.93) and remained non-significant for 'I+Te' (HR=1.66, 95% CI: 0.69 4.00) and RITe (HR=2.31 95% CI: 1.00 to 5.36).

Comparing between strategies, each additional strategy did not result in a significant incremental effect of the intervention. There was a 0.8% reduction in VMMC uptake between 'I' (3.4%) and 'I+Te' (2.6%) (p=0.387) and a 1.0% increase between 'I+Te' (2.6%) and RITe (3.6%) (p=0.601). Similarly, there was no significant incremental effect with each additional strategy on time to circumcision (between 'I' and 'I+Te' (p=0.205), 'I+Te' and RITe (p=0.215).

Secondary outcome

In the univariable analysis, there were no associations between time to circumcision and the following: age, HIV status, educational level, marital status, availability of electricity or water as proxies for economic status. Having genital warts was associated with an increased rate of receiving circumcision (RR=6.32, 95% CI: 1.43 to 27.75) (table 3). We did not evaluate the association between the time to circumcision and the following: condom use during last sex, number of sexual partners and whether men had given or received money/goods/favours for sex due to few numbers of events. In the multivariable analysis including genital warts, age, HIV status, educational level, marital status and availability of electricity or water, only having genital warts was independently associated with time to circumcision (adjusted relative risk=18.74, 95% CI: 2.04 to 172.45).

DISCUSSION

Our intervention effectively improved the uptake and time to uptake of VMMC among men with STIs, however, the overall uptake remained low. The IHE and transport reimbursement implementation blocks significantly increased VMMC uptake while the IHE and SMS/telephonic tracing implementation blocks improved time to uptake of VMMC, compared with SOC. There was no incremental effect on VMMC uptake and time to VMMC between the implementation blocks. We found that men with genital warts were more likely to receive circumcision.

As indicated earlier, interventions with education or counselling are among the most effective at increasing VMMC uptake.[16] Based on behavioural theories, education raises awareness, dispels fears and misconceptions and aids in a change in attitude that leads to a change in behaviour.[21] The IHE strategy was selected because of its potential for high impact. Education or counselling helps to inform men about VMMC and clear fears and misconceptions resulting in a positive attitude towards VMMC.[21] Education was delivered through group education and individual counselling within the clinic. Health education was tailor-designed to inform men with STIs about the specific benefits of VMMC and to dispel misconceptions and improve attitudes towards VMMC. Similar to many

Table 1 Sociodemographic characteristics of uncircumcised men who attended the Bwaila STI clinic between February and August 2021

Characteristic	All men, n=2230	Standard of care, n=514	Intensified health education, n=731	Intensified heath education and SMS/ telephonic tracing, n=508	Intensified health education, SMS/ telephonic tracing and transport reimbursement, n=477
Age (years) Mean (±SD)	30 (9)	31 (9)	30 (8)	31 (8)	30 (7)
Age categories (years), n (%)					
≤18 years	72 (3.2)	14 (2.7)	17 (2.3)	16 (3.2)	25 (5.3)
19–29 years	1107 (49.8)	264 (51.4)	362 (49.7)	233 (46.0)	248 (52.3)
30–39 years	666 (30.0)	155 (30.2)	225 (30.9)	161 (31.8)	125 (26.4)
≥40 years	377 (17.0)	81 (15.7)	124 (17.0)	96 (19.0)	76 (16.0)
Marital status, n (%)					
Single	874 (39.4)	207 (40.4)	280 (38.4)	189 (37.3)	198 (41.8)
Married/cohabiting	1297 (58.4)	293 (57.1)	435 (59.8)	305 (60.3)	264 (55.7)
Divorced	44 (2.0)	12 (2.3)	10 (1.4)	12 (2.4)	10 (2.1)
Widowed	6 (0.2)	1 (0.2)	3 (0.4)	0 (0)	2 (0.4)
Education, n (%)					
None	50 (2.3)	13 (2.5)	14 (2.0)	11 (2.2)	12 (2.5)
Primary	864 (38.9)	193 (37.6)	287 (39.4)	207 (40.9)	177 (37.3)
Secondary	1165 (52.4)	272 (53.1)	384 (52.7)	254 (50.2)	255 (53.8)
>Secondary	142 (6.4)	35 (6.8)	43 (5.9)	34 (6.7)	30 (6.4)
Electricity, n (%)					
Yes	670 (30.2)	158 (30.7)	215 (29.6)	145 (28.8)	152 (32.2)
No	1546 (69.8)	356 (69.3)	511 (70.4)	359 (71.2)	320 (67.8)
Running water, n (%)					
Yes	716 (32.3)	178 (34.8)	215 (29.6)	158 (31.3)	165 (34.9)
No	1501 (67.7)	334 (65.2)	512 (70.4)	347 (68.7)	308 (65.1)
HIV status, n (%)					
Positive	140 (6.4)	28 (5.5)	45 (6.3)	38 (7.6)	29 (6.1)
Negative	1966 (89.5)	446 (88.9)	652 (90.6)	445 (88.8)	423 (89.5)
Discordant	3 (0.1)	0 (0)	2 (0.3)	1 (0.2)	0 (0)
Unknown	87 (4.0)	28 (5.6)	21 (2.8)	17 (3.4)	21 (4.4)
Condom use during last sex, n (%)*					
Yes	36 (3.9)	8 (3.1)	9 (2.9)	3 (2.0)	16 (8.2)
No	884 (96.1)	251 (96.9)	306 (97.1)	149 (98.0)	178 (91.8)
Number of sexual partners in last 4 weeks, n (%)*					
0	23 (2.5)	8 (3.1)	8 (2.6)	3 (2.7)	4 (2.1)
1	876 (96.0)	247 (95.7)	300 (96.5)	110 (97.3)	183 (94.8)
≥2	14 (1.5)	3 (1.2)	3 (0.9)	0 (0.0)	5 (3.1)
Received money, good or favours for sex in the last 4 weeks, n (%)*					
Yes	11 (1.2)	5 (1.9)	4 (1.3)	1 (0.7)	1 (0.5)
No	902 (98.8)	253 (98.1)	307 (98.7)	150 (99.3)	192 (99.5)
Gave someone money, goods or favours for sex in the last 4 weeks, n (%)*					
Yes	110 (12.1)	17 (6.6)	34 (10.9)	32 (21.2)	27 (14.1)
No	802 (87.9)	241 (93.4)	277 (89.1)	119 (78.8)	165 (85.9)

Continued

Table 1 Continued

Characteristic	All men, n=2230	Standard of care, n=514	Intensified health education, n=731	Intensified heath education and SMS/ telephonic tracing, n=508	Intensified health education, SMS/ telephonic tracing and transport reimbursement, n=477
STI diagnosis, n (%)†					
Balanitis	182 (9.3)	46 (10.6)	49 (7.6)	41 (9.4)	46 (10.6)
Genital ulcer disease	416 (21.3)	85 (19.7)	126 (19.4)	110 (25.1)	95 (21.8)
Genital warts	19 (0.9)	10 (2.3)	4 (0.6)	4 (0.9)	1 (0.2)
Urethral discharge	858 (43.9)	181 (41.9)	278 (42.8)	202 (46.1)	197 (45.2)
Other‡	480 (24.6)	110 (25.5)	192 (29.6)	81 (18.5)	97 (22.2)
Number of diagnoses, n (%)					
1	1823 (93.2)	409 (94.7)	592 (91.2)	417 (95.2)	405 (92.9)
≥2	132 (6.8)	23 (5.3)	57 (8.8)	21 (4.8)	31 (7.1)

*The denominator is the total number of people whose data were available.
†This is a count of all diagnoses. Some patients had more than one diagnosis on a single visit.
‡The other diagnoses/syndromes include scrotal swelling, persistent urethral discharge, phimosis, paraphimosis, anorectal infections and other non-STI diagnoses.
SMS, short-messaging services; STI, sexually transmitted infections.

studies,[16 24–28] IHE effectively increased VMMC uptake and improved time to uptake in our study.

In addition, we used a trained mobiliser and satisfied male clients and female partners to assist with the education sessions, as part of social, peer and intimate partner influence, known facilitators to VMMC uptake.[6 9 11 16 29] Satisfied male clients are instrumental in providing awareness on VMMC due to their personal experiences with VMMC.[11 30] They are more trusted by their peers and are better placed to address common fears and misconceptions.[30] Likewise, peer/intimate partner influence from females is an effective and acceptable strategy in increasing demand and uptake for VMMC as they motivate their partners and children to receive VMMC.[9 26 31 32] We believe that the combined use of tailored group health education and individual counselling, satisfied male clients and a female champion led to positive attitudes toward VMMC resulting in increased demand and VMMC uptake in our study.

Likewise, financial incentives have been very effective in increasing the uptake of VMMC, including in this study.[15 16] A recent meta-analysis showed significant impact of financial incentives on VMMC uptake up to five times higher (relative risk: 5.23, 95% CI: 3.13 to 8.76).[33] Based on this evidence, financial incentives in the form of transport reimbursement were selected for our intervention to offset the cost associated with accessing VMMC, one of the major barriers to VMMC uptake.[6 7] VMMC involves the cost of transportation to the clinic for the procedure and for at least one physical follow-up visit, a minimum of 2 days of rest immediately after the procedure, and another 7 days of light work. In addition, there are fears of loss of income during the recovery period post-VMMC.[5] These factors result in a considerable immediate financial burden which may outweigh the perceived long-term benefits of VMMC for most men in the region.[33–36] We believe by addressing these barriers in our study, we were able to significantly increase uptake of VMMC.

Table 2 Uptake of circumcision among men who attended Bwaila STI clinic

Circumcision	Standard of care	Intensified health education	Intensified heath education and SMS tracing	Intensified health education, SMS/telephonic tracing and transport reimbursement	Full intervention*
Offered/\sensitised	514	731	508	477	1716
Circumcised	8	25	13	17	55
Uptake (%)	1.6	3.4	2.6	3.6	3.2
Per cent increase, % (p value)	NA	113 (0.044)	63 (0.259)	125 (0.044)	100 (0.048)

*Full intervention includes all men who attended the Bwaila STI clinic during the study implementation period excluding the standard of care phase.
NA, not applicable; SMS, short messaging services; STI, sexually transmitted infections.

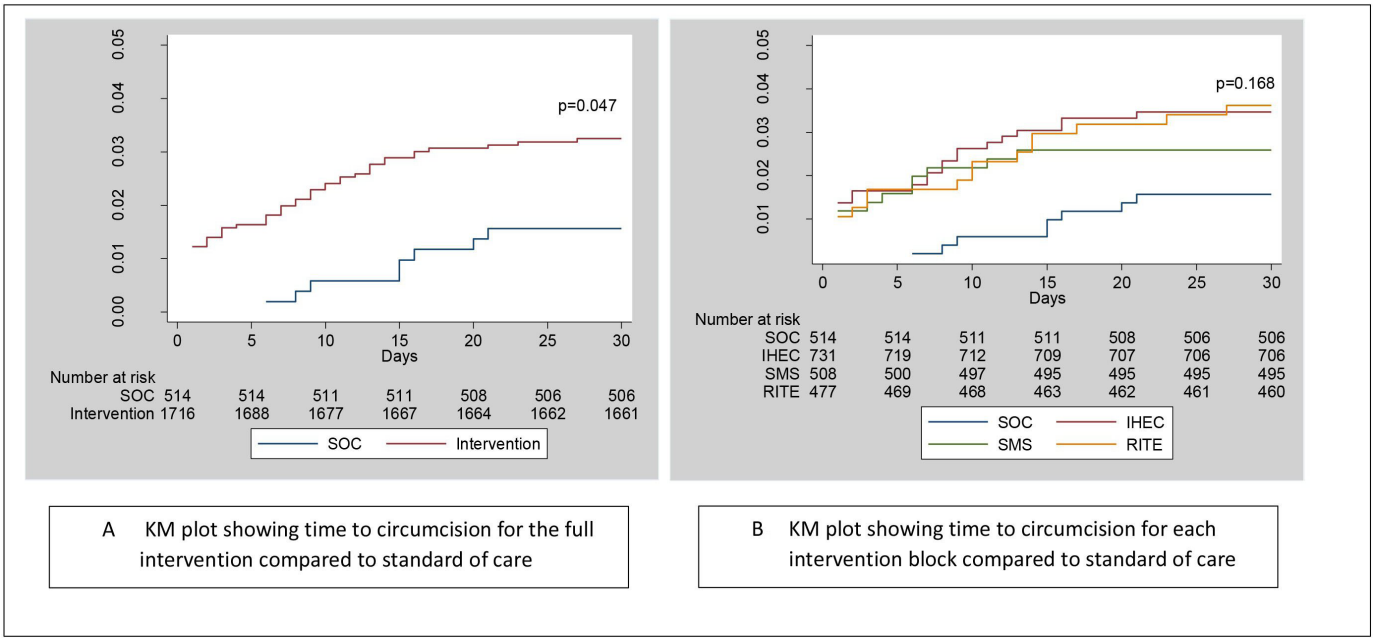

Figure 2 Comparison of median time to circumcision among men at Bwaila clinic between the RITe intervention and standard of care. IHEC, intensified health education consulting; RITE, reimbursement ('R'), intensified health education ('I') and short-messaging services/telephonic tracing ('Te'); SMS, short-messaging services; SOC, standard of care.

Financial incentives between US$8.75[37] and US$17[36] vouchers are considered adequate and non-coercive in a sub-Saharan African (SSA) setting. In our study, we found that adding transport reimbursement of US$10 to IHE and cell phone reminders resulted in the highest increase in VMMC uptake. However, since routinely providing financial incentives may be a challenge in an SSA setting, providing incentives through short-term mop-up exercises or campaigns, preferably through stakeholder sponsorship, could be a better approach for this strategy.[36]

Cell phone reminders (SMS and calls) used alone or in combination with other strategies have yielded mixed results in increasing VMMC uptake.[38–42] In Kenya, cell phone reminders resulted in a modest improvement in attendance of a postcircumcision clinic at day 7 in older men.[40] In Uganda, cell phone reminders significantly increased uptake of circumcision among men in the Rakai community cohort[38] while they did not significantly increase uptake in Zambia.[39]

Initially, since the VMMC clinic was no longer colocated at Bwaila hospital, reminders were selected to remind men who could not receive same-day VMMC to go to their nearest clinic for VMMC. However, reminders did not significantly increase VMMC uptake in our study. In Malawi, access to mobile phones was estimated at 48% in 2019.[43] In our study, about 61% of participants owned a phone, 30% without a phone provided an alternative phone number belonging to someone they trusted and 9% did not own a phone. It is likely that the low cell phone coverage in the country compounded by network disruptions and power interruption or lack of power may have influenced the impact of this block on VMMC uptake.

Interestingly, men had the quickest time to circumcision during the SMS/telephonic intervention block with a median time of 3 days. Our hypothesis is that the reminders may have helped motivate men who already expressed interest in VMMC, though they were few, resulting into quicker turn-up.

As shown in the introduction, many researchers have studied predictors to/factors associated with uptake of VMMC. However, there are some inconsistencies in the results. For instance, older age[6 44] and younger age,[12 45] and being employed[46] or unemployed[44] have been associated with increased VMMC uptake. Sociodemographic factors that have consistently predicted VMMC uptake include higher education (secondary school and above),[10 12 46] belief of improved sexual performance[10 12 47] and having two or more sexual partners or high self-perceived risk of HIV.[12 14 45] Other factors reported include culture/ethnicity (tribes such as Shona,[48] Yao[49]), religion (being Muslim[49]), higher socioeconomic status and geographical location (urban areas).[49] In our population of men with STIs, sociodemographic and sexual–behavioural factors did not predict VMMC uptake. This could be partly attributed to small sample sizes for the predictor analyses due to missing data for some variables.

In our study, we found that men with genital warts were 18 times more likely to undergo VMMC. We are unaware of studies that looked at the relationship between genital warts or other clinical factors and uptake of circumcision. A few studies report associations between circumcision and human papillomavirus acquisition/clearance and genital warts prevalence but not the effect of genital warts on uptake of VMMC.[50 51] We cannot dismiss the possibility

Table 3 Predictors of uptake of circumcision among uncircumcised men at Bwaila STI clinic

Variable	Unadjusted relative risk (95% CI)	P value	Adjusted relative risk model (95% CI)	P value
HIV status				
Positive	–			
Negative	(reference)			
Unknown and discordant	1.88 (0.77 to 4.58)	0.163		
Age				
<25 years	(reference)	0.823		0.510
≥25 years	1.07 (0.59 to 1.95)		1.24 (0.65 to 2.36)	
Education				
None	(reference)			
Primary and secondary	1.18 (0.17 to 8.40)	0.867	1.23 (0.17 to 8.79)	0.836
>Secondary	2.11 (0.26 to 17.12)	0.484	2.15 (0.25 to 18.33)	0.484
Marital status				
Married/cohabiting	(reference)			
Single	1.38 (0.81 to 2.33)	0.233	1.92 (0.63 to 5.92)	0.254
Divorced and widowed	0.93 (0.13 to 6.67)	0.940	1.04 (0.14 to 7.54)	0.967
Electricity				
No	(reference)			
Yes	1.12 (0.64 to 1.96)	0.644	0.94 (0.21 to 4.25)	0.937
Running water				
No	(reference)			
Yes	0.94 (0.53 to 1.65)	0.824	2.06 (0.47 to 8.92)	0.336
Gave money, goods or favours for sex in the last 4 weeks				
No	(reference)			
Yes	0.45 (0.06 to 3.34)	0.434	0.59 (0.08 to 4.59)	0.618
STI diagnosis				
Other*	(reference)			
Urethral discharge	1.61 (0.73 to 3.57)	0.242	1.71 (0.35 to 8.38)	0.510
Genital ulcer disease	1.15 (0.44 to 3.05)	0.773	1.66 (0.28 to 9.82)	0.576
Genital warts	6.32 (1.43 to 27.75)	0.015	18.74 (2.04 to 172.45)	0.010
Balanitis	2.3 (0.85 to 6.27)	0.849	1.15 (0.11 to 12.54)	0.909

*The other diagnoses/syndromes include scrotal swelling, persistent urethral discharge, phimosis, paraphimosis, anorectal infections and other non-STI diagnoses.
STI, sexually transmitted infection.

of genital warts acting as a proxy for other sexual risk behaviours that we were unable to measure.

Recently, Chen *et al* showed that men were more satisfied if they underwent circumcision for phimosis or balanitis.[52] Phimosis and balanitis are conditions that affect the foreskin and glans penis causing tightness (irretractable foreskin) and inflammation, respectively. Since genital warts commonly affect the foreskin and glans penis, we hypothesise that men with genital warts likely had a stronger motivation to circumcise due to the unpleasant look, foul smell and loss of sexual activity that are common with genital warts, resulting in more satisfaction and higher uptake.

Our study had about 6–7 months of implementation and a 30-day follow-up period for each participant. Worth noting, a systematic review showed studies with longer implementation and follow-up times have reported higher uptake of VMMC.[15] This is because it takes time for men exposed to interventions to decide to undergo VMMC as the VMMC decision-making pathway involves progression through multiple stages of change over time.[15] We believe that the impact of our intervention would have been greater given a longer implementation and follow-up period. Although the overall uptake in our study was low, our uptake level is comparable to a recent three-arm randomised controlled trial in Zambia where

uptake was 1.1%, 1.5% and 1.8% for three different intervention arms[39] and several other studies.[15]

In addition, age could have played a role in our findings. Our study largely comprised older men who are mostly associated with low VMMC uptake[12 45] due to unique barriers they face such as fear of postsurgical abstinence, and fear of losing income.[53] It is possible that some men who required treatment completion and could not receive same-day VMMC may have lost interest or fallen outside the follow-up window, equally contributing to the low uptake. Due to the predesign and postdesign and implementation of the intervention in blocks of time, there may be temporal factors that affected our outcomes that are immeasurable. Nonetheless, our study is one of a few to present effective strategies for reaching men accessing care for STIs and increasing demand, uptake and speed of uptake of VMMC a in real-world setting using implementation science methods.

Our intervention effectively improved the uptake and time to uptake of VMMC among men with STIs, however, the overall uptake remained low. Achieving high uptake of VMMC among men is challenging. In order to achieve high VMMC uptake, it is worth prioritising different subpopulations of men who are at high risk of HIV acquisition, understanding the specific barriers and facilitators unique to the subpopulations and addressing the barriers and/or capitalising on the facilitators with a combination of strategies that are acceptable, appropriate, feasible and cost-effective. This should be the focus of future studies. Since health education is simple and inexpensive but very effective, we recommended that it should be scaled up to all settings where men can be reached while other interventions such as cell phone reminders and transport reimbursement should be used as short-term 'mop-up' interventions.

Author affiliations
[1]University of North Carolina Project-Malawi, Lilongwe, Malawi
[2]Department of Epidemiology and Biostatistics, University of the Witwatersrand, Johannesburg, South Africa
[3]Public Health, University of the Witwatersrand, Johannesburg, South Africa
[4]Institute of Global Health and Infectious Diseases, University of North Carolina at Chapel Hill School of Medicine, Chapel Hill, North Carolina, USA

Twitter Mitch M Matoga @UNCMalawi and Sara Jewett @snieuwoudt

Acknowledgements We would like to thank the Malawi Ministry of Health Department of HIV, Hepatitis and sexually transmitted infections, specifically, Martin Kapito the voluntary medical male circumcision (VMMC) programme manager, the Johns Hopkins Programme for International Education in Gynecology and Obstetrics (JHPIEGO) VMMC team, Bwaila STI clinic team including Dumbo Yatina, Billy Ulemuwatha and Cecilia Msowoya. We are also thankful to the community advisory board which provided input on the design of this research.

Contributors MMM, MCH, SJ, CC and the community advisory board contributed to the conceptualisation and design of the study. MMM, EK and MC assisted with statistical analysis. BN, EM, NB, EJ and BK assisted with data collection and curation. MMM drafted this manuscript. All authors reviewed and approved the manuscript. MMM is the guarantor, he accepts full responsibility for the work and/or the conduct of the study, had access to the data and controlled the decision to publish.

Funding This project was supported by NIH Fogarty grant # D43 TW009340, D43 TW010060 and D43 TW009774-06. The study sponsors have not had any role in the study design and will not play a role in collection, management, analysis and interpretation of data; writing the report and the decision to submit the report for publication.

Competing interests None declared.

Patient and public involvement Patients and/or the public were involved in the design, or conduct, or reporting or dissemination plans of this research. Refer to the Methods section for further details.

Patient consent for publication Not required.

Ethics approval This study has been approved by the University of the Witwatersrand Human Research Ethics Committee (HREC#: M200328), the National Health Sciences Research Ethics committee of Malawi (NHSRC#: 19/10/2412), the University of North Carolina at Chapel Hill Ethics Review Board (IRB#: 19-2559) and registered with the US National Library of Medicine (NLM) at the National Institutes of Health Clinical Trial Registry (NCT04677374). Written informed consent was obtained from all participants.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available upon reasonable request. Data set and statistical code will be made available by request from the University of North Carolina Project Malawi data repository, email: mmatoga@unclilongwe.org.

ORCID iDs
Mitch M Matoga http://orcid.org/0000-0002-6542-8193
Sara Jewett http://orcid.org/0000-0002-6658-2061

REFERENCES

1 UNAIDS. *On the Fast-Track to end AIDS. 2016-2021 Strategy*. Geneva, Switzerland: UNAIDS and WHO, 2021.
2 UNAIDS & World Health Organisation (WHO). *UNAIDS & World Health Organisation (WHO). Voluntary medical male circumcision: Progress Report*. Geneva, Switzerland, 2021.
3 National AIDS Commission. *National VMMC Communication Strategy 2020-2025*. Lilongwe, Malawi: National AIDS Commission, 2019.
4 Malawi Ministry of Health. *Integrated HIV Program Report October - December 2020*. Lilongwe, Malawi: Ministry of Health, 2021.
5 Mfutso Bengo J, Chalulu K, Jobiba Chinkhumba F, *et al*. *Situation analysis of male circumcision in Malawi. Blantyre*. 2010.
6 Masese R, Mwalabu G, Petrucka P, *et al*. Key challenges to voluntary medical male circumcision uptake in traditionally circumcising settings of Machinga district in Malawi. *BMC Public Health* 2021;21:1957.
7 Masese RJ, Chimango JL, Mbirimtengerenji ND. Overcoming barriers to uptake of voluntary medical male circumcision in a traditionally circumcising community in Machinga district. *WJA* 2017;07:40–58.
8 Umar E, Mandalazi P, Jere D, *et al*. Should female health providers be involved in medical male circumcision? narratives of newly circumcised men in Malawi. *Malawi Med J* 2013;25:72–7.
9 Mhagama P, Makono P, Tsitsi C, *et al*. Communication-related factors influencing the uptake of voluntary medical male circumcision among men in Lilongwe urban. *Cogent Medicine* 2021;8.
10 Tusabe J, Muyinda H, Nangendo J, *et al*. Factors influencing the uptake of voluntary medical male circumcision among Boda-Boda riders aged 18–49 years in Hoima, Western Uganda. *HIV AIDS (Auckl)* 2022;14:437–49.
11 Sun Y, He L, Gao Y, *et al*. Barriers and Facilitators to, and experience of, voluntary medical male circumcision among men who have sex with men in China: A mixed-methods study. *Arch Sex Behav* 2023;52:2065–81.
12 Rosen JG, Carrasco MA, Traub AM, *et al*. Barriers, benefits, and behaviour: voluntary medical male circumcision Ideation in a population-based sample of Zambian men. *Afr J AIDS Res* 2021;20:314–23.
13 Zamawe COF, Kusamula F. What are the social and individual factors that are associated with undergoing male circumcision as an HIV prevention strategy? A mixed methods study in Malawi. *Int Health* 2016;8:170–8.

14 Ong KS, Laube C, Mohan D, *et al*. Factors beyond compensation associated with uptake of voluntary medical male circumcision in Zambia. *AIDS Behav* 2023;27:1836–48.
15 Atkins K, Yeh PT, Kennedy CE, *et al*. Service delivery interventions to increase uptake of voluntary medical male circumcision for HIV prevention: A systematic review. *PLoS One* 2020;15:e0227755.
16 Ensor S, Davies B, Rai T, *et al*. The effectiveness of demand creation interventions for voluntary male medical circumcision for HIV prevention in sub-Saharan Africa: a mixed methods systematic review. *J Int AIDS Soc* 2019;22:e25299.
17 Matoga MM, Hosseinipour MC, Jewett S, *et al*. Uptake of voluntary medical male circumcision among men with sexually transmitted infections in Lilongwe, Malawi: a protocol for a pre-Interventional and post-Interventional study. *BMJ Open* 2022;12:e057507.
18 Malawi National Statistical Office. *The Malawi Demographic Health Survey 2015*. Zomba: National Statistical Office, 2015.
19 Chen JS, Matoga M, Khan S, *et al*. Estimating Syphilis Seroprevalence among patients in a sexually transmitted infections clinic in Lilongwe. *Int J STD AIDS* 2020;31:359–63.
20 Powell BJ, Waltz TJ, Chinman MJ, *et al*. A refined compilation of implementation strategies: results from the expert recommendations for implementing change (ERIC) project. *Implement Sci* 2015;10:21.
21 Sgaier SK, Baer J, Rutz DC, *et al*. Toward a systematic approach to generating demand for voluntary medical male circumcision: insights and results from field studies. *Glob Health Sci Pract* 2015;3:209–29.
22 Maibvise C, Mavundla TR. A model to promote the uptake of male circumcision as an HIV-preventive measure in high HIV and low male circumcision prevalence settings. *Health SA* 2019;24:1070.
23 Proctor EK, Powell BJ, McMillen JC. Implementation strategies: recommendations for specifying and reporting. *Implement Sci* 2013;8:139.
24 Ashengo TA, Hatzold K, Mahler H, *et al*. Voluntary medical male circumcision (VMMC) in Tanzania and Zimbabwe: service delivery intensity and modality and their influence on the age of clients. *PLoS One* 2014;9:e83642.
25 Miiro G, DeCelles J, Rutakumwa R, *et al*. Soccer-based promotion of voluntary medical male circumcision: A mixed-methods feasibility study with secondary students in Uganda. *PLoS One* 2017;12:e0185929.
26 Wambura M, Mahler H, Grund JM, *et al*. Increasing voluntary medical male circumcision uptake among adult men in Tanzania. *AIDS* 2017;31:1025–34.
27 Weiss SM, Zulu R, Jones DL, *et al*. The spear and shield intervention to increase the availability and acceptability of voluntary medical male circumcision in Zambia: a cluster randomised controlled trial. *Lancet HIV* 2015;2:e181–9.
28 Montague C, Ngcobo N, Mahlase G, *et al*. Implementation of adolescent-friendly voluntary medical male circumcision using a school based recruitment program in rural Kwazulu-natal, South Africa. *PLoS One* 2014;9:e96468.
29 Carrasco MA, Wilkinson J, Kasdan B, *et al*. Systematic review of barriers and Facilitators to voluntary medical male circumcision in priority countries and programmatic implications for service uptake. *Glob Public Health* 2019;14:91–111.
30 World Health Organization. *Case studies on enhancing uptake of voluntary medical male circumcision services. Case study 2: Using satisfied clients to bring older men to VMMC services in Chikwawa District, Malawi Setting*. Geneva, Switzerland: WHO, 2020.
31 Cook R, Jones D, Redding CA, *et al*. Female partner acceptance as a Predictor of men's readiness to undergo voluntary medical male circumcision in Zambia: the spear and shield project. *AIDS Behav* 2016;20:2503–13.
32 Lanham M, L'engle KL, Loolpapit M, *et al*. Women's roles in voluntary medical male circumcision in Nyanza province, Kenya. *PLoS One* 2012;7:e44825.
33 Kennedy CE, Yeh PT, Atkins K, *et al*. Economic compensation interventions to increase uptake of voluntary medical male circumcision for HIV prevention: A systematic review and meta-analysis. *PLoS ONE* 2020;15:e0227623.
34 World Health Organization. Models to inform fast tracking voluntary medical male circumcision in HIV combination prevention: meeting report, 23–24 March 2016. Geneva, Switzerland. 2017.
35 Awad SF, Sgaier SK, Ncube G, *et al*. A reevaluation of the voluntary medical male circumcision scale-up plan in Zimbabwe. *PLoS One* 2015;10:e0140818.
36 Lukobo-Durrell M, Aladesanmi L, Suraratdecha C, *et al*. Maximizing the impact of voluntary medical male circumcision for HIV prevention in Zambia by targeting high-risk men: A pre/post program evaluation. *AIDS Behav* 2022;26:3597–606.
37 Thirumurthy H, Masters SH, Rao S, *et al*. Effect of providing conditional economic compensation on uptake of voluntary medical male circumcision in Kenya a randomized clinical trial. *JAMA* 2014;312:703–11.
38 N K, G N, S W, *et al*. The impact of cell phone reminders on uptake of medical male circumcision in Rakai, Uganda. *J AIDS Clin Res* 2017;08:02.
39 Leiby K, Connor A, Tsague L, *et al*. The impact of SMS-based interventions on VMMC uptake in Lusaka province, Zambia: A randomized controlled trial. *J Acquir Immune Defic Syndr* 2016;72:S264–72.
40 Odeny TA, Bailey RC, Bukusi EA, *et al*. Text Messaging to improve attendance at post-operative clinic visits after adult male circumcision for HIV prevention: A randomized controlled trial. *PLoS One* 2012;7:e43832.
41 Msungama W, Menego G, Shaba F, *et al*. Sexually transmitted infections (STI) and Antenatal care (ANC) clinics in Malawi: effective platforms for improving engagement of men at high HIV risk with voluntary medical male circumcision services. *Sex Transm Infect* 2021;97:345–50.
42 Barnabas RV, van Rooyen H, Tumwesigye E, *et al*. Uptake of antiretroviral therapy and male circumcision after community-based HIV testing and strategies for linkage to care versus standard clinic referral: A Multisite, open-label, randomised controlled trial in South Africa and Uganda. *The Lancet HIV* 2016;3:e212–20.
43 The World Bank. Mobile cellular Subscriptions (per 100 people) - Malawi | data. the world Bank (IBRD, IDA). 2019. Available: https://data.worldbank.org/indicator/IT
44 Mangombe K, Kalule-Sabiti I. Predictors of male circumcision among men aged 15–35 years in Harare, Zimbabwe. *J Biosoc Sci* 2018;50:193–211.
45 Ortblad KF, Bärnighausen T, Chimbindi N, *et al*. Predictors of male circumcision incidence in a traditionally non-circumcising South African population-based cohort. *PLoS One* 2018;13:e0209172.
46 Odoyo-June E, Agot K, Grund JM, *et al*. Predictors of voluntary medical male circumcision prevalence among men aged 25-39 years in Nyanza region, Kenya: results from the baseline survey of the TASCO study. *PLoS One* 2017;12:e0185872.
47 Ganczak M, Korzeń M, Olszewski M. Attitudes, beliefs and predictors of male circumcision promotion among medical university students in a traditionally non-circumcising region. *Int J Environ Res Public Health* 2017;14:1097.
48 Rupfutse M, Tshuma C, Tshimanga M, *et al*. Factors associated with uptake of voluntary medical male circumcision, Mazowe district, Zimbabwe, 2014. *Pan Afr Med J* 2014;19:337.
49 Tram KH, Bertrand JT. Correlates of male circumcision in Eastern and Southern African countries: establishing a baseline prior to VMMC scale-up. *PLoS One* 2014;9:e100775.
50 Shapiro SB, Laurie C, El-Zein M, *et al*. Association between male circumcision and human Papillomavirus infection in males and females: a systematic review, meta-analysis, and meta-regression. *Clin Microbiol Infect* 2023;29:968–78.
51 Zhu Y-P, Jia Z-W, Dai B, *et al*. Relationship between circumcision and human Papillomavirus infection: A systematic review and meta-analysis. *Asian J Androl* 2017;19:125–31.
52 Chen CH, Cheng WM, Fan YH, *et al*. Factors influencing satisfaction with male circumcision in Taiwan. *Sci Rep* 2023;13:2313.
53 Plotkin M, Castor D, Mziray H, *et al*. Man, what took you so long?'" social and individual factors affecting adult attendance at voluntary medical male circumcision services in Tanzania. *Glob Health Sci Pract* 2013;1:108–16.