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Measuring the impact of SMS-based interventions on uptake of voluntary medical male circumcision in Zambia

October 2016

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HIV and AIDS

3ie International Initiative for Impact Evaluation

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Summary

Two five-month SMS campaigns designed to increase voluntary medical male circumcision (VMMC) uptake were piloted in urban Lusaka and peri-urban Chongwe District with Zambia U-Report, a free and confidential short message service (SMS) platform designed for subscribers to access information and SMS counselling on sexual health issues. In both campaigns, participants received a total of 21 messages providing information about VMMC, encouraging engagement with counsellors and prompting uptake of VMMC. In the 'conventional' campaign, all participants received the same comprehensive package of messages. In the 'tailored' campaign, participants received messages targeted towards their level of intention to get circumcised.

A three-arm randomised controlled trial was used to measure the impact of both campaigns on self-reported and verified VMMC uptake. Secondary outcomes included reported intention to go for VMMC and engagement with U-Report counsellors.

There were 2,312 participants enrolled in the study. Participants were U-Report subscribers, registered as males aged 15–30 and living in the study area, who responded to a baseline survey saying they were uncircumcised. Qualitative phone interviews with 40 participants were used to explore potential mechanisms of impact.

The main source of data was from three SMS surveys administered at two-month study intervals, which collected self-reported uptake and intention to go for VMMC, as well as limited participant characteristics. Client data were also collected from health centres to cross-check and verify self-reported uptake.

Other data sources included anonymous counsellor interactions, semi-structured phone interviews and U-Report cost figures.

The primary analyses of self-reported and verified outcomes failed to detect a statistically significant impact of either SMS-based campaign on VMMC uptake. Estimates based on the self-reported data ranged from 11 per cent (p-value=0.56) to a 99 per cent (p-value=0.09) greater odds of VMMC uptake for the conventional arm compared with the control arm and 24 per cent (p-value=0.28) to 90 per cent (p-value=0.12) greater odds of VMMC update for the tailored arm. Using the verified data, the conventional arm is estimated to have had a 34 per cent (p-value=0.60) greater odds of VMMC uptake compared to the control arm, and the tailored arm is estimated to have had 33 per cent (p-value=0.51) lower odds.

The campaigns had large impact on counsellor engagement and demand for information on VMMC. In the treatment arms, 53 per cent of participants messaged counsellors outside of survey windows, versus 15 per cent in the control arm; 20 per cent of treatment-arm participants engaged counsellors on at least five separate occasions, versus 5 per cent in the control arm. These differences were statistically significant at the $p<0.01$ level.

Anecdotes from interviews and counsellor interactions suggest potential for impact with at least some participants. However, the role that U-Report played is likely nuanced.

Uptake outcomes did not indicate campaign impact. Although the campaigns yielded a high proportion of treatment-arm participants engaging counsellors, engagement was not visibly associated with uptake during the study window. Important study limitations, including statistical power to detect differences in uptake of less than 3 percentage points and survey contamination in the control arm, are important for context. This evaluation examined particular campaign strategy and content with a specific sample of self-enrolled U-Report participants. Future research is still necessary to fully understand the potential of SMS-based tools for VMMC demand creation, either alone or in conjunction with other interventions.

Acknowledgements

This evaluation was possible thanks to the contribution of several project teams that were each integral to the evaluation's success, contributing to the implementation of the pilot and the evaluation and always providing valuable program and evaluation insights.

CHAMP's U-Report Programme Team managed CHAMP's implementation pieces, recruiting rural subscribers in Chongwe, overseeing and monitoring the U-Report counsellor centre, organising stakeholder activities, and organising interviews with study participants, among other activities. It also facilitated partnership with the 990 Talkline and coordinated project support and interview scheduling from the SMS counselling centre. We thank the U-Report and 990 counsellors who contributed significant time to the study by interviewing participants.

At UNICEF Zambia, Priscilla Chomba-Kinywa was involved at every stage of project design and implementation, providing invaluable guidance. Andre Lesa, U-Report's software developer, was also involved at every stage of the project. He programmed and tested each SMS survey, implemented the SMS campaigns, managed access to data, and always provided valuable technical input.

IDinsight's field team managed client data collection and was adept at working with health facilities and district counterparts. Sam Zulu introduced the project to facilities, Charity Muchanga managed the field schedule and Rose Lungu supported field activities while also managing interview implementation from the evaluation side.

Other partners were also critical to the project's success and deserve recognition:

The Lusaka and Chongwe District Health Offices facilitated access to client records at government facilities. The district VMMC coordinators, Christine Jango and Mabel Changala, introduced the field team to clinics and kept the study team well-informed of VMMC activities on the ground.

Other organisations made their time available and provided access to data, including Society for Family Health, the Centre for Infectious Disease Research in Zambia, Jhpiego and the University Teaching Hospital.

Finally, we thank all of the men who took part in the study, responding to SMS surveys and, in some cases, sharing their opinions and thoughts with us in longer interviews.

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Abbreviations and acronyms

3ie	International Initiative for Impact Evaluation
ASE	Attitude-social influence-self efficacy
ICER	Incremental cost-effectiveness ratio
MC	Male circumcision
mHealth	Mobile health
SMS	Short message service
STI	Sexually transmitted infection
UNAIDS	Joint United Nations Programme on HIV/AIDS
UNICEF	United Nations Children's Fund
VMMC	Voluntary medical male circumcision
WHO	World Health Organization

1. Introduction

In 2012 there were 2.3 million new HIV infections, adding to the 35.3 million people living with HIV around the globe (UNAIDS 2013). Effective prevention strategies remain paramount to achieving Millennium Development Goal 6, which, in part, calls for halting the spread of HIV/AIDS (United Nations 2000). Voluntary medical male circumcision (VMMC) has been shown to reduce the risk of heterosexual HIV transmission from women to men by around 60 per cent (Auvert *et al*. 2005; Bailey *et al.* 2007; Gray *et al.* 2007; Mills *et al.* 2008). In response to these findings, the World Health Organization (WHO) and the Joint United Nations Programme on HIV/AIDS (UNAIDS) recommended including VMMC as a component of a comprehensive HIV prevention package (WHO & UNAIDS, 2007). National governments and international partners have since worked together to increase access to quality VMMC services around the world.

Zambia is one of 14 countries in East and Southern Africa with high HIV prevalence and low circumcision rates prioritised to expand VMMC services and increase uptake (WHO & UNAIDS 2011). Around 12.7 per cent of the adult Zambian population is HIV-positive, with over five new infections every hour (UNAIDS 2013). However, in 2007, only 13 per cent of males aged 15–49 years were circumcised (Central Statistical Office *et al.* 2009). Recognising the promise of VMMC to prevent HIV, the Government of Zambia set national targets to circumcise 80 per cent of its HIV-negative male population between the ages of 15-49 by performing 1,864,396 circumcisions by 2015 (Republic of Zambia Ministry of Health 2012). Achieving this ambitious target could potentially avert 339,632 new HIV infections and save the government US$2.4 billion by 2025 (Njeuhmeli *et al.* 2011).

However, efforts to promote VMMC in Zambia have produced only modest results. Only 340,992 VMMCs had been performed from 2008–2012, representing 18 per cent of the 2015 target (WHO Regional Office for Africa 2013). Having greatly increased the availability of VMMC services, Zambia is shifting focus to stimulating demand since demand, not supply, is now the major bottleneck hindering Zambia's VMMC efforts (Republic of Zambia Ministry of Health 2013).

A systematic review of acceptability of circumcision in Sub-Saharan Africa prior to most national programme scale-up revealed common barriers to uptake around: apprehension of pain; perceptions of cultural, ethnic or religious disapproval; direct and opportunity costs involved; and fear of complications (Westercamp & Bailey 2007). Zambia's National Communication Strategy developed with stakeholders highlights key barriers that can be addressed through information, relating to service availability, quality of services (addressing possible misconceptions) and issues relating to pain, bleeding and healing time (Republic of Zambia Ministry of Health 2012b).

Until recently, few evaluations have examined the effectiveness of VMMC demand creation strategies. Countries in southern and eastern Africa have primarily boosted circumcision rates through broad-based efforts such as supply-side service provision and procedure subsidisation, media engagement, mass media advertisement,

engagement with community leaders and community mobilisation, (Mwandi *et al.* 2011). There are fewer data, however, on targeted interventions, despite the fact that new tactics will be needed to achieve national targets. An impact evaluation in Malawi found that – while costs appeared to be an important barrier to uptake – neither varied subsidy levels nor comprehensive information had any meaningful effects on uptake (Thornton *et al.* 2014). However, forthcoming results from studies in Kenya and South Africa suggest potential for financial incentives to increase uptake (Agot *et al*. forthcoming; Wilson *et al.* forthcoming). One intensive soccer-based intervention with youth in Zimbabwe including in-person accompaniment successfully increased demand for VMMC (Kaufman *et al.* forthcoming), but less intensive postcard advertising in South Africa did not appear to be effective (Wilson *et al.* forthcoming).

Mobile health (mHealth) interventions may be effective at increasing demand for VMMC. The existing evidence on the potential for short message service (SMS) interventions to impact behaviour and to increase health service uptake is mixed. A review of nine evaluations of SMS interventions to influence disease prevention and management in developing countries found eight to be effective as a behaviour change tool (Cole-Lewis & Kershaw 2010). Other studies have found or suggested impact of SMS-based interventions on health knowledge acquisition (Chib *et al.* 2012; Lim *et al.* 2012), adoption of safer health behaviours (Free *et al.* 2011) and uptake and adherence to HIV biomedical interventions such as drug regimens, condom use, HIV testing and antiretroviral therapy *(*Finitsis *et al.* 2014; Gold *et al.* 2011; Lester *et al.* 2010; Odeny *et al.* 2014b; Pop-Eleches *et al.* 2011). Several studies have also found modest impact of SMS-reminders on adhering to appointments (Gurol-Urganci *et al.* 2013), including a study by Odeny *et al.* (2012), which found a 5.7 percentage points increase in the likelihood to adhere to VMMC post-operation follow-up visits among patients receiving SMS reminders compared to those who did not receive reminders.

Other studies, however, have produced less promising results. Odeny *et al.* (2014a) examined the effect of a series of text messages on deterring the resumption of sexual activity of recently circumcised men but found no difference in the likelihood of this risky behaviour compared to a control group. A Cochrane review found limited indications that mobile phone messaging had a positive impact on self-management of long-term illness, though there were only four studies that matched the inclusion criteria (de Jongh *et al.* 2012). Another review found very limited evidence that mobile phone messaging related to preventive health care had any effect on improved health status or health behaviour outcomes (Vodopivec-Jamsek *et al.* 2012).

Several organisations have experimented with SMS interventions to increase VMMC uptake, but reliable impact evidence is still forthcoming. In 2012 Grassroot Soccer piloted an SMS-based intervention to promote VMMC among young men in Zimbabwe who completed the organisation's HIV/AIDS curriculum, alongside other activities (Kaufman & DeCelles, n.d.). In 2010 and 2011, Text to Change created a platform to push SMS messages offering VMMC-related information to individuals in Tanzania who opted into a government programme's campaign promoting VMMC. A total of almost 15,000 individuals requested information by SMS about the advantages of VMMC, places to access male circumcision (MC) or post-operative guidelines

(Hoefman *et al.* 2012). The Text to Change study demonstrated the ability of SMS platforms to reach a large number of people cost-effectively and to attract questions about VMMC via SMS.

Overall, there is a paucity of rigorous evaluations of SMS-based interventions on uptake of health services, such as VMMC, with adequately large sample sizes. Additionally, little evidence exists on interventions which tailor messages to individuals based on participant characteristics such as age, location and mind-set.

This technical report presents the methods and findings from a three-arm randomised controlled trial of two SMS-based campaign strategies – one broad-based and another targeting participants based on their intention level – to promote VMMC uptake in urban and peri-urban areas of Lusaka Province, Zambia. All study participants were subscribers on the Zambia U-Report SMS platform, which provides health messages and access to confidential SMS counselling around HIV/AIDS, STIs and other sexual health topics.

This randomised controlled trial had one primary aim and four secondary aims. The primary aim was to measure the impact of the two campaign strategies on VMMC uptake.

Secondary aims were to measure intermediate outcomes and understand campaign effectiveness:[1]

- Measure the impact of the two campaign strategies on self-reported intention to receive VMMC among Zambia U-Report participants in Lusaka Province.
- Measure the impact of campaign messages on engagement with U-Report counsellors.[2]
- Obtain qualitative insights on SMS-based VMMC behaviour change to guide potential at-scale operations or programme modification.
- Map intervention costs and cost-effectiveness.[3]

The impact evaluation is one of seven VMMC-focused evaluations supported by an International Initiative for Impact Evaluation (3ie) thematic funding window. Findings

[1] An original aim described in the proposal was to look at the number of participants unsubscribing from U-Report. However, no participants actually unsubscribed from the platform. A very small number of participants implied that they wanted to unsubscribe or to stop receiving campaign messages (particularly females and those who said they were already circumcised), but these requests were not fully tracked.

[2] This aim was not included in the project's original proposal, and it was added after the data became available.

[3] This aim was not explicitly discussed in the project's original proposal but is essential for interpreting the results for policymakers.

from this evaluation, in conjunction with the other evaluations, will help fill a critical global knowledge gap regarding VMMC demand creation.

This report is divided into four sections. The first section provides details on the campaign strategies and their theories of change. The second section presents the evaluation methodology, including descriptions of the sample, data collection methods and analytic methods. The third section presents the evaluation findings, including primary and secondary results, subsample analyses and sensitivity analyses. Finally, the findings are synthesised and contextualised in a discussion section, followed by conclusions including recommendations to policymakers, operational lessons and remaining research questions.

2. Intervention overview, theory of change and research hypotheses

Two campaigns were run on the Zambia U-Report platform aimed at getting subscribers to go for VMMC.

2.1 U-Report VMMC campaign interventions

Each campaign variant consisted of sending 21 SMS messages to relevant U-Reporters over a five-month period from 7 May to 5 October 2014. These campaigns sought to motivate U-Reporters to uptake VMMC by providing information, encouraging broader interaction with SMS counsellors around VMMC and prompting participants to make a decision and go for the procedure.

In a 'conventional' campaign, all participants received a comprehensive package of messages employing different behaviour change tactics with information relevant to participants across a spectrum of intention levels and of VMMC awareness.

In a 'tailored' campaign, participants received targeted messages employing the same behaviour change tactics but containing information relevant to their specific self-reported intention to go for VMMC. Participants were polled at baseline and at two- and four-month campaign intervals to re-assess intention levels and to re-target the campaign.

More details are discussed with the campaigns' theories of change.

2.2 Zambia U-Report

Both campaigns were deployed on Zambia U-Report to subscribers who were enrolled at the start of the evaluation. Zambia U-Report is an SMS-based platform designed to give young people access to information related to HIV/AIDS, sexually transmitted infections (STIs) and other sexual health issues.[4] An initiative of the National HIV/AIDS

[4] Zambia U-Report's focus may be broadened beyond sexual health issues. Examples of other issue-areas that have been discussed by U-Report implementers as possible topics into which the platform could be expanded include drugs/alcohol abuse and employment.

Council, U-Report was developed by UNICEF Zambia and is implemented by CHAMP.[5] Though anyone with a Zambian mobile phone number can enrol on the U-Report platform, it is targeted towards young people.

Since its launch in December 2012, over 76,000 phone numbers have been voluntarily registered on Zambia U-Report.[6] Self-enrolling participants – called 'U-Reporters' – usually hear about the platform through mass media, promotion at large events, community mobilisation and from peers. All participants are anonymous and interactions are confidential.[7]

Zambia U-Report has three capabilities:

- **Message pushing**: Policymakers and programme implementers can send informational and promotional messages to participants
- **Two-way SMS counselling**: Participants may confidentially engage 24-hour counsellors via SMS on any topic related to HIV/AIDS, STIs and sexual health
- **SMS polling**: Surveys can be sent to participants to elicit opinions or information

The interventions tested in this evaluation leveraged all three of these capabilities.

2.3 Campaign content and theory of change

For the purposes of this evaluation, a bank of VMMC-related SMS messages was developed by the project team and stakeholders that align with Zambia's National VMMC Communication and Advocacy Strategy. The messages targeted barriers relating to information and perceptions.

Draft messages were piloted and rated by groups of young men on two dimensions. The first dimension was derived from the Stages of Change framework (National Institutes of Health, U.S. Department of Health and Human Services 2005; Prochaska, DiClemente & Norcross 1992) which delineated messages by *relevance* to participants with different intention levels – pre-contemplation, contemplation and preparation. Messages were assessed on their relevance to individuals in each stage of change category:

- **Pre-contemplation SMS package**: Messages contain basic information indicating the benefits of VMMC, addressing common misconceptions,

[5] CHAMP is a non-profit Zambian organisation implementing various health and social programs in Zambia, including providing health services at workplaces and mobilising communities. CHAMP runs counselling centres for U-Report as well as the free 990 Talkline.
[6] As of February 2015.
[7] No identifying information is requested from subscribers or ever recorded. Only UNICEF has access to full participant phone numbers, which counsellors or evaluators cannot see, for example.

attempting to alleviate common concerns about VMMC and promoting VMMC as being socially acceptable.

- **Contemplation SMS package:** Messages provide more sophisticated information on VMMC benefits as well as information about VMMC procedures and promotional cues to motivate decision-making.

- **Preparation SMS package:** Messages provide information that participants need to turn their intentions into action. These messages refer participants to clinics, provide more procedure details and seek to reinforce decision-making and logistical knowledge.

The model also provided a basis for measuring participants' progress towards VMMC uptake as a secondary outcome (table 1).

Table 1:Stages of change model, adapted to VMMC interventions

Stage	Study indicators (self-reported)
Pre-contemplation	No current intention to go for VMMC
Contemplation	Intention to go for VMMC in the next 6 months
Preparation	Intention to go for MC in the next 2 months (with steps presumably being taken towards goal)
Action	VMMC received (primary outcome)

The second dimension guiding the message content was derived from the Attitude-Social Influence-Self Efficacy (ASE) framework (de Vries *et al.* 1988) and delineated messages by their behaviour change *tactic*:

- **Attitude SMS:** Messages seek to change negative attitudes and reinforce positive attitudes towards VMMC. SMS content aims to increase U-Reporter self-awareness about HIV risk, to increase knowledge of VMMC benefits and to correct and mitigate the common misconceptions about VMMC.

- **Social Influence SMS:** Messages motivate uptake of VMMC by improving individuals' own perceptions of MC's social acceptability.

- **Self-Efficacy SMS:** Messages reduce uncertainty and aim to reinforce the individual's confidence in himself to endure the challenges of the VMMC procedure. These messages increased knowledge of VMMC procedures, addressed the fear of pain/excess bleeding and informed about the availability of service with effective referral to closer VMMC service provision site.

The full campaign message bank is included in appendix A. Figure 1 includes sample messages for each stage of change and utilising different ASE tactics. Some

messages could be relevant to multiple stages of change, and messages could also utilise multiple tactics.

Figure 1: Three example messages[8]

Pre-contemplation message (*social influence dimension*)

'Hello! Surveys in Zambia found that most women who know about MC prefer circumcised men. Top reason is disease prevention, 2nd reason is sexual satisfaction'.

Contemplation message (*attitude dimension*)

'Hi U-Reporter! MC helps protect u from more than HIV--Syphilis, HPV, Penile cancer, etc… Any Questions?'

Preparation message (*self-efficacy dimension*)

'Hi U-Reporter! Meds and proper care will make MC ez 4 u. Ask ur counsellor where to go for safe MC clinics near you, open weekdays and weekends, too'.

The interventions and individual messages only provided information or pushed participants to action. A hypothesis of this evaluation was that ASE perception and intention barriers can be addressed to induce uptake, but that does not discount the possibility that *other* barriers – particularly barriers related to efficacy (actual ability) rather than self-efficacy (belief in ability) – matter for *some but not all* men. In Zambia, VMMC is currently provided for free and is locally available for most men in the study area. Some private providers facilitate transportation. Therefore, opportunity costs – such as those related to healing time, time off from work or school, and/or lost wages – rather than direct costs may be more relevant in this study's context. Those costs are not addressed by this study's interventions.

The theory of change models presented here only apply fully to uncircumcised men without major barriers to uptake relating to cost or ability to go for VMMC. For some men, therefore, a predicted end outcome of the intervention would be increased intention to go for VMMC but not action.

The campaigns' theories of change also rested on the assumption that different types of messages resonate with different segments of the population. Therefore, a range of messages were included in campaign packages targeting different groups and using the ASE tactics.

Figure 2 illustrates the conventional campaign's theory of change in which a standard, comprehensive package of messages that span the range of stages-of-change and ASE messages are sent to everyone. The ASE tactics are not necessarily employed in any specific order.

[8] Some messages employed shorthand to compress content into 160 characters. Piloting focus groups also emphasised the importance of using 'hip' language.

Figure 2: 'Conventional' campaign theory of change

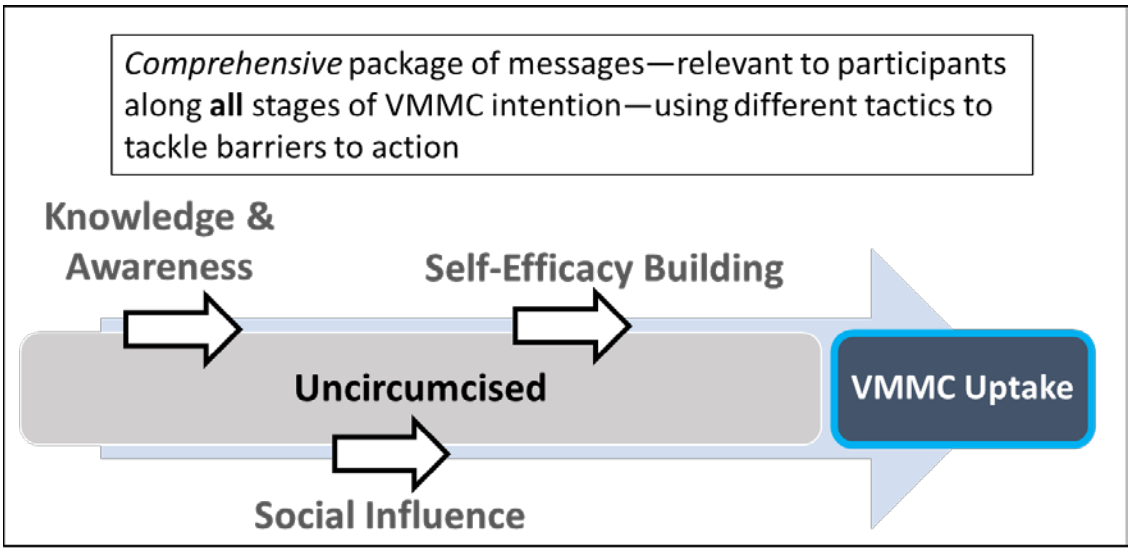


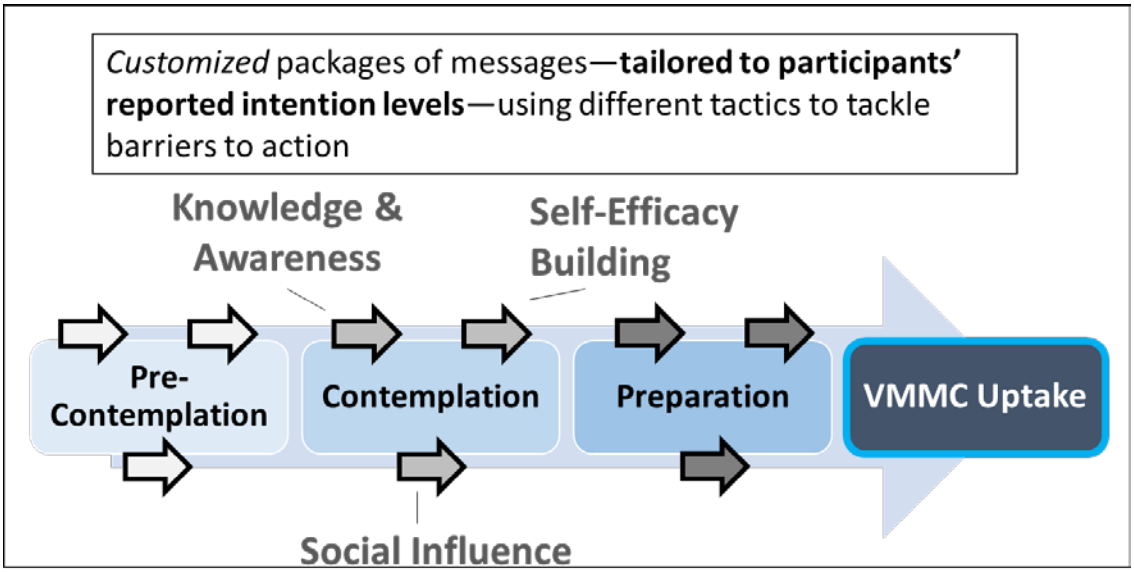
Figure 3 shows the theory of change model for the more refined tailored campaign, which sends ASE messages separately to participants in each stage of change on the way to uptake. In this campaign, participants were sent an initial seven messages depending on the intention level they reported at baseline, while two- and four-month follow-up surveys reassessing intention served to 're-tailor' the second and third seven-message packages received. The theory of change for this campaign acknowledges that different information and tactics are relevant for participants at different stages of change, and presumably, with different levels of awareness. Therefore, a more targeted campaign may have greater influence on intentions and uptake.

Some evidence suggests that tailored messages could be more effective. A study looking at the effectiveness of an SMS-based weight loss programme found messages that were tailored to participants' weight and personal goals resulted in more weight loss compared to no intervention (Haapala *et al.* 2009). Another study targeting youth between the ages of 8–18 successfully used SMS-based messages tailored to participants' age, sex and personal insulin regimen to improve glycaemic control among Type I diabetes patients (Franklin *et al.* 2006). Tailored messages can serve to boost participant engagement and retention and can result in higher self-efficacy and more positive perceptions of the intervention itself (Fjeldsoe *et al.* 2009; Ryan & Lauver 2002).

However, some scepticism is also warranted, and the results of tailored interventions are mixed (Radhakrishnan 2012). A systematic review of stage-based interventions aimed at health behaviour revealed limited evidence for the effectiveness of the interventions to either move participants through stage progressions or act (Bridle *et al.* 2005). Part of the challenge is defining and applying concrete stages to a theoretical model of behaviour change and then connecting those stages to effective intervention strategies; however, intention-based theory of planned behaviour may have more utility (Armitage & Arden 2002). In this study's tailored campaign,

messages for participants assigned to the Pre-Contemplation arm (no reported intention to go for VMMC) tended to receive messages with more basic information about VMMC and its benefits; participants assigned to the Preparation stage (reported intention to go for VMMC within two months) received more actionable information as well as more encouragement to take action.

Figure 3: 'Tailored' campaign theory of change



These theories of change exist within a broader environment of barriers and facilitators that influence a man along his decision-making process towards VMMC uptake. While the theories behind these campaigns attempt to address many of the possible barriers that a man could face as he moves from pre-contemplation to action, the influence of the intervention was designed to be through improved access to information as well as encouragement and perception modification.

Each campaign variant included a different mix of messages (pulling from a common bank of messages), but the frequency and timing of messages was the same across campaigns. Message delivery was partially dictated by the study's six-month timeline and by the schedule of follow-up surveys. In each of three two-month campaign segments between surveys, messages were frontloaded with about five messages in the first month and two in the next. In the last two-month campaign segment, all messages were sent in the first month.

The five-month campaign period and six-month study period were partially influenced by a grant period and an interest in producing results quickly. However, the time period was also assumed to be policy-relevant and sufficient for participants to take up behaviour in response to the campaigns. Ultimately, this study focused on near-term returns which – if detected – would also likely reflect longer term impact.

2.4 Research hypotheses

The evaluation tested two hypotheses. The first hypothesis was that a standard package of messages that covered an array of tactics and stages of change in addition to confidential access to SMS counselling would result in higher uptake of VMMC compared to access to SMS counselling alone. The second hypothesis was that participants would be more likely to undergo VMMC if they received messages that are targeted at one's intention level to go for VMMC (tailored) than if they received a standard SMS package that included messages addressing all three stages of change.

2.5 Outcomes of interest

The primary outcome of interest was VMMC uptake, measured in terms of self-reported and verified uptake. Secondary outcomes were self-reported intention to go for VMMC and demand for information, as measured by engagement with U-Report counsellors. Descriptions and measurements of these evaluation outcomes are discussed in detail in the Methodology section.

3. Study context and sample

3.1 Study area

The study was conducted in Lusaka Province, an area characterised by high phone ownership among young people, high HIV infection rates, and high concentration of U-Reporters. A national survey in 2010 estimated that only 53 per cent of all respondents were regular phone users, compared to 87 per cent in Lusaka Province (AudienceScapes 2010). HIV prevalence among Zambian males between 15–49 in Lusaka province is 19 per cent (Central Statistical Office *et al.* 2009), and national VMMC targets require nearly 300,000 males in Lusaka province to be circumcised between 2012 and 2015 (Republic of Zambia Ministry of Health 2013).

Within Lusaka Province, Lusaka District and Chongwe District were included in the study. Lusaka District is Zambia's major urban centre and has the highest number of enrolled U-Reporters of all districts (table 2), as well as high HIV rates. Chongwe District was included in the study at the request of policymakers interested in potential for impact in peri-urban and rural locations. The district's commercial and administrative centre is 40 km from the City of Lusaka.

Table 2: Study area districts

	Lusaka	Chongwe	Source
Population (2010)	1,084,703	137,461	[1]
% male	51%	51%	[1]
Number of U-Reporters	39,358	1,695	[2]
% of total U-Reporters	51.7%	2.2%	[2]

Note: Sources: [1] Central Statistical Office (2003); [2] Zambia National AIDS Council, n.d.

In 2007, before Zambia's National VMMC Campaign was launched, 10.2 per cent of men aged 15–49 were circumcised in Lusaka Province, compared with 12.7 per cent

nationwide (CSO *et al.* 2009). Since that time, over 750,000 men had been circumcised in Zambia by June 2014, implying a nationwide circumcision rate of more than 30 per cent among men aged 15–49 (MCDMCH 2014). While uptake in Lusaka has lagged behind other parts of the country, such as in Copperbelt Province, services were fully scaled and available in the study area, which has been subject to high levels of mass media engagement by the government and its partners. Therefore, men in Lusaka who remain uncircumcised may be both more aware of VMMC and more reluctant to go.

Changes to the study area's service provision landscape – including concluded funding for service providers and evolving partner support for facilities – are discussed in the next section alongside the study timeline.

3.2 Sample context

Outside of evaluation activities, self-enrolled U-Reporters hear about the platform in different ways. Mass media avenues including TV ads and celebrity endorsements have been highly effective at boosting registrations. Other platform enrolees have heard about U-Report from promotion at large events (e.g. agricultural fairs) and at smaller-scale mobilisation within communities. Finally, social networks also generate sign-ups.

In order to bolster low numbers of U-Reporters in Chongwe District for the purposes of the evaluation, CHAMP did a recruitment drive in Chongwe shortly before the evaluation started. Because of time pressures, CHAMP could not take advantage of large events or mass media outlets, as is typically done, but instead used community mobilisation tactics, including promotion events at community events, schools and churches in the district. Therefore, almost all U-Reporters in Chongwe at the time of the baseline survey were recruited via on-the-ground promotion within a few months prior to the start of the evaluation. While these recruitment methods are occasionally used outside of the evaluation context, it is more common for U-Report to use recruitment methods that can reach a large population with limited investment of time and resources.

Since U-Reporters are anonymous, the population is largely understood from inference around recruitment methods (e.g. young people exposed to television public service announcements or attending events with mobilisers) and from the limited information that participants provide when they register (sex, age, location). As of February 2015, 58 per cent of the 76,112 registered U-Reporters were male and 52 per cent were registered in Lusaka Province. Around 87 per cent of U-Reporters were between the ages of 15 and 29 (21 per cent 15–19, 47 per cent 20–24 and 19 per cent 25–29) (UNICEF n.d.).[9]

Basic English literacy among U-Report participants is presumably high. English is the official language of Zambia. Consequently, U-Report has primarily been advertised in

[9] U-Report population metrics are kept updated at http://www.zambiaureport.org/web/metrics/.

English and operates in the language. The vast majority of incoming messages to counsellors are in English (e.g. more than 99 per cent of messages from final study participants). However, English proficiency of users is unlikely to be universally strong and may be a predictor of engagement with the platform. Weak English ability likely affects ability to answer SMS questionnaires on the margins.

Little can be inferred about the sample's specific awareness or knowledge of VMMC, although the study area's exposure to significant messaging has been noted. Additionally, it is likely that U-Reporters on the whole, who are relatively more educated and who purposely subscribed to a platform focused on issues relating to STIs and sexual health, are more aware of VMMC than non-subscribers.

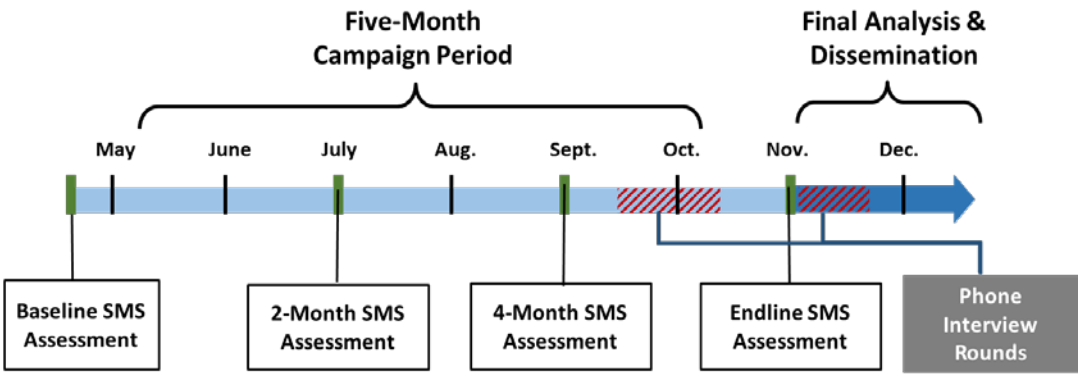
Some basic inferences can also be made about the sample frame, as young mobile phone users (and likely owners). Mobile phone owners in sub-Saharan Africa tend to be wealthier, better educated, more urban, younger, and male relative to the general population (Aker & Mbiti 2010). A 2010 national survey in Zambia found that more than 87 per cent of respondents with post-secondary or higher education were regular phone users, while less than 37 per cent of respondents with only primary education were regular users (AudienceScapes 2010).

Because of these differences, the U-Report sample frame in Lusaka is not likely to be representative of the population at large.

4. Programme implementation and timelines

A baseline survey was implemented from 16–28 April 2014 (figure 4). Participants were subsequently screened for study eligibility and randomly assigned to three study arms during the three weeks that followed. The study officially launched on 7 May, marked by the first campaign messages sent to participants in the conventional and tailored arms. The study period for the purposes of analysis ran from 7 May to 24 October 2014 and was roughly divided into three two-month intervals – during which campaign participants received seven campaign messages each – punctuated by follow-up SMS surveys sent to all participants.

Figure 4: Evaluation timeline (2014)



Three national (non-evaluation) VMMC campaigns coinciding with school holidays, advertising, and resource mobilisation take place each year. The study began at the tail end of the April campaign (which ran into the beginning of May) and overlapped with the August campaign running from August through the first half of September.

VMMC services in the study area were heavily supported or provided directly by partner organisations, some of which were affected by funding wind-down:

- Marie Stopes International – Zambia ceased support of VMMC by the end of May.
- Society for Family Health (Population Services International-Zambia) stopped supporting government facilities and closed its two private VMMC centres (two of the largest providers in Lusaka) at the end of August.
- Several large government facilities stopped providing VMMC temporarily in September until outside support was reintroduced from Jhpiego and the Centre for Infectious Disease Research in Zambia.

Despite disruptions at some sites, all study participants could access many large VMMC sites throughout the study period. However, these disruptions may have marginally decreased uptake by making it more difficult for clients to find a VMMC site.

5. Process evaluation

Table 3 outlines the major intervention development and implementation activities, along with other project milestones affecting the programme's launch. Implementation went largely as planned, but some implementation challenges are worth highlighting:

- *Chongwe recruitment*: On-the-ground recruitment was planned in Chongwe to facilitate VMMC campaign implementation and evaluation in the peri-urban district. However, even after add-on recruitment activities, four total weeks of recruitment activities only yielded a total of 1,218 male U-Reporters registered in Chongwe, and of the 530 (44 per cent) who responded to the baseline survey, only 210 (40 per cent of respondents) said they were uncircumcised.[10]
- *Exploring the operational potential of rural recruitment* was of interest in itself, especially for policymakers interested in exploring the feasibility of rural implementation. To make rural recruitment cost-effective, more strategic methods would be needed to take advantage of large, natural gatherings of people.
- *Lapse in message delivery*: Due to an error in linking certain tailored arm participants to message assignments in July and August, 96 campaign participants (12.5 per cent of 771 total tailored arm participants) did not receive seven messages. The error was caught too late to be corrected. Overall, of the

[10] These rates were similar to those for Lusaka baseline participants.

16,191 messages intended for tailored campaign participants over six months, 15,519 (96 per cent) were delivered.

- *Counsellor response time*: The most frequent suggestion for improving the U-Report platform by U-Reporters participating in interviews was that counsellors should respond to questions faster to facilitate real-time conversations. During periods with high traffic, U-Reporters could wait for a response for over a day, and some questions apparently never received responses. This was especially an issue at the beginning of the campaign – possibly an important period – when campaign messages elicited high levels of engagement with counsellors. Throughout most of the campaign period, the average response time for questions was over one hour. Important technical and capacity constraints, including slow servers, affected the ability of counsellors to respond to messages efficiently. These challenges can continue to be addressed.

Table 3: Implementation milestones, December 2013–October 2014

Month	Milestone
Dec	Grant agreement signed by CHAMP and 3ie
Jan	IRB protocol submitted IDinsight contracted by CHAMP
Feb	IRB approval received U-Reporter recruitment in Chongwe District Stakeholder meeting and SMS message development session Initial meetings with VMMC provider partners and start of site mapping Ministry of Health approval for study
Mar	Campaign content development and piloting VMMC counsellor workshop and trainings Research authorisation from Lusaka province and district health offices
Apr	Baseline survey programming and implementation Randomised assignment of participants to study arms MCDMCH and Chongwe District Health Office research approvals
May–Jun	Campaign launched 7 May First set of seven messages delivered over six weeks 1st follow-up SMS survey sent
Jul–Aug	Second set of seven messages delivered over six weeks 2nd follow-up SMS survey sent
Sep–Oct	Third set of seven messages delivered over six weeks 3rd follow-up SMS survey sent

6. Methodology: evaluation design and implementation

6.1 Evaluation question and outcomes

This evaluation was designed to answer the question: *What are the impacts of two different SMS-based campaign strategies on VMMC uptake?*

Since study participants were anonymous and VMMC client uptake records at facilities were incomplete, self-reported and verified outcomes were each used as proxies for *actual* uptake (table 4). Self-reported uptake consisted of a participant responding 'yes' to the question, 'Are you circumcised, meaning that the foreskin was removed from the head of your penis?' on an SMS survey. This positive response was possibly accompanied by site details and date of uptake. Different variations of the outcome definition were tested based on consistency of responses and specificity of additional information provided. These variations are discussed in detail in the Impact Analysis section. Participants were considered to have verified uptake if they reported being circumcised, and a phone number match was identified in client records from the reported VMMC site. We only verified reported circumcisions; we did not verify that those who reported not being circumcised were, in fact, uncircumcised. Raw self-reported data were expected to overestimate actual uptake, and verified data were expected to underestimate uptake.

Table 4: Primary outcomes: VMMC uptake

Primary outcome	Description	Data Sources
Self-reported uptake	Uptake reported in SMS surveys, usually supported by reported sites and dates of uptake	SMS surveys (three surveys at two-month intervals after campaign launch)
Verified uptake	Registered participant details (last five phone number digits, age, neighbourhood) and self-reported uptake details (site and date) matched with client records	SMS surveys Client intake forms

Secondary outcomes also measured intermediary steps to VMMC uptake in accordance with the campaigns' theories of change (table 5).

Table 5: Secondary outcomes: intermediary steps to uptake

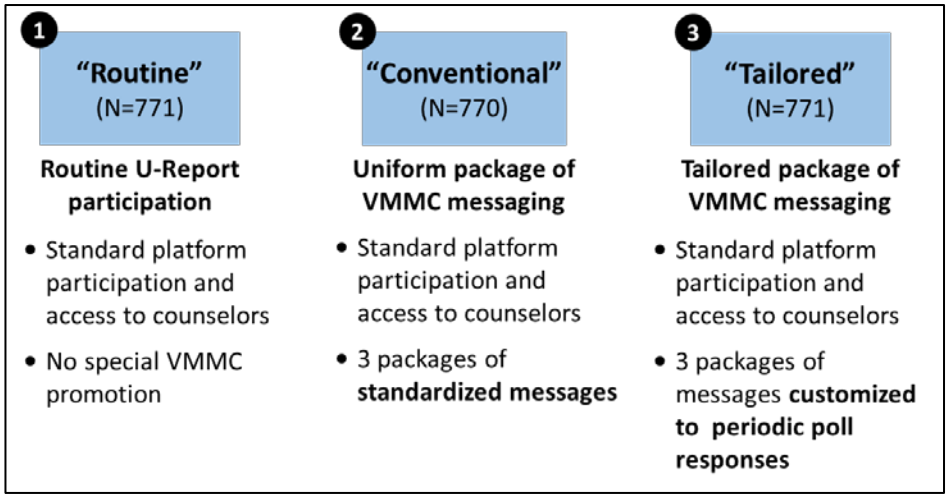
Secondary outcome	Description	Data sources
Self-reported intention to go for VMMC	Three levels of intention: 1. No intention to go for VMMC 2. Intention to go for VMMC *at some point* 3. Intention to go for VMMC within the next two months	SMS surveys (three surveys at two-month intervals after campaign launch)
Demand for information	Questions sent to SMS counsellors relating to VMMC	Six months of U-Report activity data (counsellor interactions)

6.2 Design and sampling

The study was designed as a three-armed randomised trial, as shown in figure 5. The final sample size was ultimately limited by availability of eligible participants and

responsiveness to the baseline screening survey. Sample size calculations to measure a 3 percentage points effect size at 80 per cent power in the case of 2 per cent control group uptake determined a target sample of 2,550 participants (accounting for projected 20 per cent attrition). However, only 2,312 participants met the original eligibility criteria and were enrolled in the study, and 1,652 remained after attrition and revealed ineligibility. At 80 per cent power, the available sample size enabled us to detect a similar effect size of slightly less than 3 percentage points at the level of control arm uptake (see section 8). The study's original power calculations are presented in appendix D, and a more in-depth retrospective look at the evaluation's power is presented in section 8.

Figure 5: Study arms



6.2.1 Eligibility

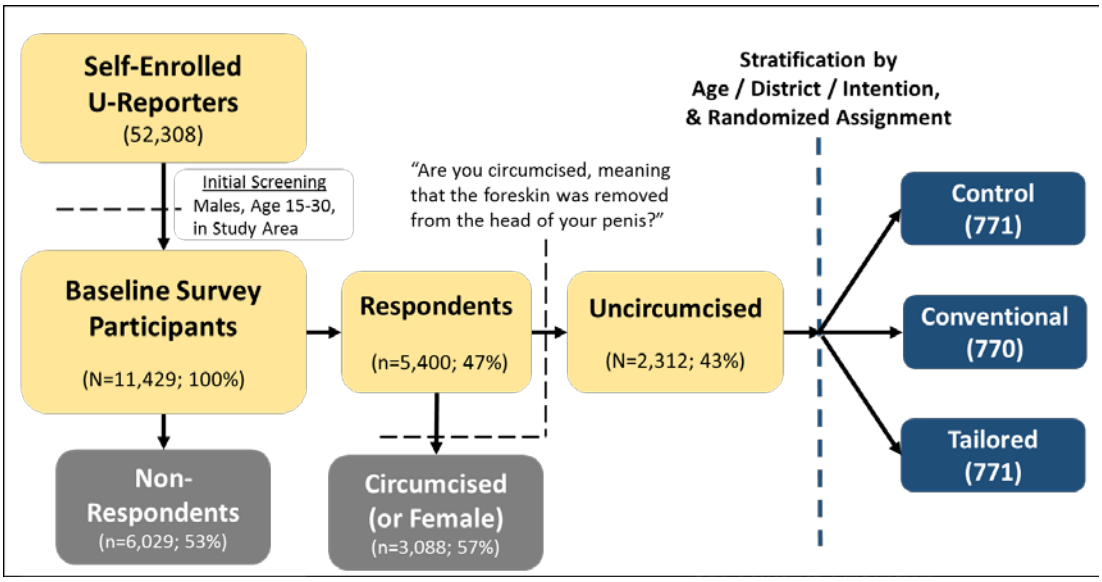
Participants were eligible for the evaluation if they were:

- Enrolled on the U-Report platform at the start of eligibility screening activities
- Registered as male
- Registered as being between the ages of 15–30
- Registered as being from Lusaka or Chongwe
- Uncircumcised at the time of the baseline survey (self-reported in the baseline survey)
- Responsive to the baseline survey[11]

[11] Self-reported baseline circumcision status had to be known prior to enrolment to measure campaign-period uptake with more clarity. The criterion was also based on the assumption that U-Reporters who responded to this initial survey would be much more likely to respond to subsequent surveys.

Eligibility screening occurred in two phases (figure 6). First, as standard procedure for the platform, all U-Reporters provide their sex, age, and town at the time of enrolment onto the platform. These registration data were used to identify those who fit the sex, age, and location eligibility criteria.[12] Second, all participants identified in the first screening phase received a baseline SMS survey, which further screened for survey responsiveness and self-reported circumcision status. Finally, to ensure balance across study arms on characteristics that could likely affect uptake, eligible participants were stratified by the three possible covariates and sub-samples of interest – district (Lusaka or Chongwe), adulthood (less than 18 or 18+ years old), and intention to go for VMMC (intention to go within two months or no such intention) – before being individually randomised to one of the three study arms. District and age sub-samples were of particular interest to policymakers during the evaluation's design phase.

Figure 6: Eligibility screening and arm assignment



6.2.2 Attrition

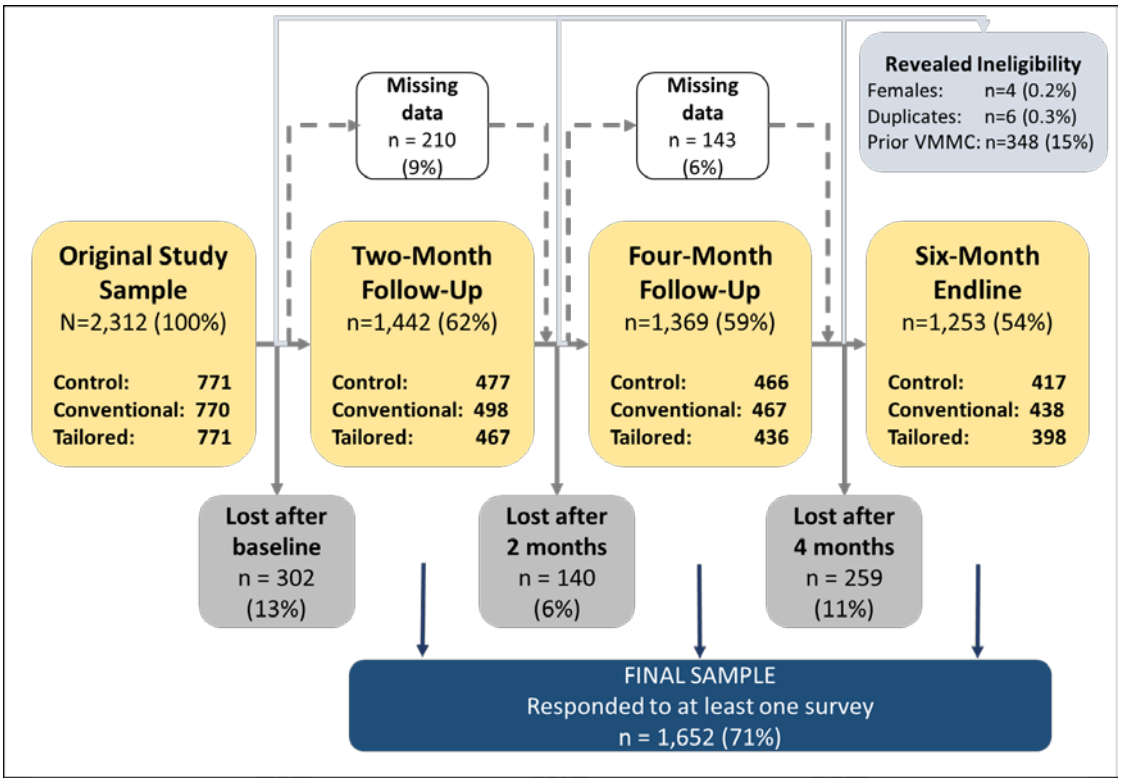
Following the baseline survey to determine eligibility, 2,312 U-Reporters met all of the eligibility criteria, were enrolled into the study and were randomised to one of the three study arms. Over the course of the six-month follow-up period, 302 participants (13 per cent) were considered lost-to-follow-up by failing to respond to any of the three follow-up SMS surveys (figure 7). An additional 358 participants (15.5 per cent) were dropped from the sample after revealing that they were ineligible for the study by stating that they were female (n=4), by being double-enrolled on the platform[13] (n=6) or by

[12] These characteristics are self-reported. If study participants stated that they were female at any point during the study, they were dropped from the original sample.

[13] In Zambia, it is not uncommon for people to have multiple SIM cards with different network providers. Since customers can request phone numbers, they sometimes request the same number which differs only by the initial three digits (network code). Two study participants were considered duplicates if they had the same last five digits of their phone number and the same reported age and town.

consistently reporting circumcision prior to the VMMC interventions (n=348). Thus, the final number of participants included in the sample was 1,652.

Figure 7: Sample survival



6.3 Data and collection activities

Data were collected from five sources: 1) existing U-Report platform data, 2) SMS surveys, 3) facility records, 4) semi-structured qualitative interviews and 5) UNICEF budgets and cost estimates.

6.3.1 U-Report platform data

Basic registration information was available on anonymous U-Reporters linked to unique ID numbers. Besides ages (used to estimate dates of birth) and neighbourhoods/towns, UNICEF also shared the last five digits of participants' phone numbers and their date of registration.

Each participant's SMS interactions with U-Report counsellors (questions and responses with time-stamps) were also used. SMS-based interactions between participants and counsellors provided data to compare against survey responses and obtain insights regarding potential pathways to uptake, participant interest in particular VMMC topics and reaction to SMS surveys and promotional messages.

6.3.2 SMS surveys

Participants received four SMS surveys during the study. The first was the baseline survey which was used to screen for final study eligibility, as well as some participant

demographics (tribe). Three very similar follow-up surveys delivered to all study participants at approximately two-month intervals asked study participants about their circumcision status and additional demographic information (circumcised family members, educational attainment and relationship statuses). Participants reporting circumcision uptake were asked where, when and why they went. Participants reporting no circumcision were asked about their intention to get circumcised.

Each survey contained four to eight simple questions, with the number of questions varying on the survey and skip-patterns executed based on responses. The number and complexity of questions were constrained by the SMS medium. Only select questions (e.g. circumcision status and intention) had required answer formats. Participants who completed surveys received an airtime voucher for 2 kwacha (~US$0.32).[14] Surveys were resent to non-responders up to four times over four to six days to elicit responses. See appendix B for SMS survey content.

6.3.3. Facility records

VMMC client data were collected from service providers across the entire study area in order to verify self-reported uptake. First, the study team collected partial phone numbers, ages, neighbourhoods and dates of uptake from all intake forms of clients who were circumcised during the relevant time period. Next, to maintain U-Reporter confidentiality, the de-identified client data were separately entered into a database for matching against study participants who reported VMMC uptake.

Since facilities collected data in different ways, a field team worked to establish and reinforce data standards with a particular focus on ensuring that client phone numbers were recorded. At the outset of the study, the study team modified or introduced client intake forms where necessary to ensure that all relevant information was collected and worked with facility staff (in-charges, providers and counsellors) to improve both data management and quality. VMMC register data helped to benchmark intake form collection. Two senior field officers routinely visited study clinics on a full-time basis to collect data and to monitor quality. At the outset of the study, many clinics did not consistently record phone numbers, some facilities did not have any system to store client forms and registers were not completed. In the month prior to the study, only 68 per cent of records for clients over 15 years of age had phone numbers; by the end of the study, over 80 per cent of the records included phone numbers.

6.3.4 Semi-structured interviews

Semi-structured phone interviews took place in two batches from 16 September to 20 November 2014. They were designed to obtain qualitative insights into the campaigns' effectiveness and to help interpret SMS survey data. Only participants who reported uptake were interviewed prior to the six-month survey at the end of October, so as not to influence participants' decisions to get circumcised. All other participants were interviewed after the six-month survey had been sent.

[14] Approximately equivalent to two minutes of talking, or seven SMS messages

Participants were purposively selected to obtain a desired spread across study arms, reported circumcision statuses, different levels of report consistencies and levels of intention. To completely preserve participant anonymity, invitees were asked to call the toll-free 990 Talkline[15] to schedule a separate interview time. They then called in to the Talkline at the designated time. Participants received an airtime voucher for 5.00 kwacha (about US$0.80) for completing an interview. U-Report/990 counsellors were trained to conduct the 20–40 minute interviews and supervised by study staff. Interviews covered topics including participant demographics, phone usage, interaction with U-Report, knowledge about VMMC, VMMC uptake or intention and experience with the VMMC campaign and the evaluation's SMS surveys (see appendix B).

In total, 40 participants were interviewed against a target of 60 completed interviews and out of 209 participants invited to call in.[16]

6.3.5 Cost data

Cost estimates for both U-Report set-up as well as U-Report operations were obtained from personal correspondence with UNICEF staff who were heavily involved in the development and implementation of the platform. These estimates are included in appendix F. Effectiveness estimates included in the cost-effectiveness model are derived from the evaluation results.

6.4 Research approval

The study's research protocol was approved by the ERES Converge IRB Board in Lusaka, Zambia. The approval permitted a sample with participants younger than 18 years of age. Government authorisation to implement the study and to collect limited client data was received from the Zambia Ministry of Health, the Zambia Ministry of Community Development, the Lusaka Provincial Medical Office, the Lusaka District Health Office and the Chongwe District Health Office. Other partners including Society for Family (PSI-SFH), the Centre for Infectious Disease Research in Zambia, Jhpiego and the University Teaching Hospital agreed to arrangements with IDinsight to provide access to the organisations' privately-held VMMC client records.

[15] U-Report is a rider program on the toll-free 990 Talkline.

[16] This low interview uptake (19 per cent) cannot be attributed solely to self-selection bias. Network problems made it difficult or impossible for many participants on Zambia's biggest mobile carrier to reach 990 when calling to schedule interviews or call in for actul interviews. Some participants also could not be scheduled for pre-designated interview slots. Two additional interviews were conducted with presumed non-participants who called in.

7. Impact analysis and results of key evaluation questions

7.1 Analysis methodology and specifications

7.1.1 Identification framework

A logistic regression model was used to estimate the relationship of respective treatment arm conditions versus the control condition on the binary outcome of VMMC uptake:

$$\Pr(Y=1 \mid X1, X2, X3 \ldots Xk) = \frac{1}{1+e^{-(\beta 0+\beta 1X1+\beta 2C2+\beta 3C3+\cdots+\beta_k C_k)}}$$

Where:

Y	is self-reported and/or verified VMMC uptake according to specific outcome criteria
β0 … β*k*	are constant coefficients
X1	is a binary variable for treatment condition (vs. control)
C2 … C*k*	are covariates

Covariates were included in the model after independently testing the relationship between study arms and outcomes. Dummy variables and other covariates were tested independently and together against various self-reported and verified uptake outcomes to determine their relevance for the model (table 6).[17]

Table 6: Covariates of VMMC uptake

Covariate	Data type	Description
Two-month VMMC intention at baseline	Binary	Randomisation assignment stratifier [vs. no intention to go for VMMC within two months]
18 years or older at baseline[18]	Binary	Randomisation assignment stratifier [vs. less than 18 years]
Chongwe District	Binary	Randomisation assignment stratifier [vs. Lusaka District]
Immediate family members circumcised	Binary	Responded that either brother or father is circumcised [vs. 'none', 'not sure' or missing data]
Number of follow-up surveys responded to	Integer (1, 2, 3)	Number of responses to survey question on circumcision status

[17] Other covariates tested for relevance included education levels, relationship statuses, multiple phone ownership, phone sharing, date of registration, U-Report activity prior to study, irreconcilable differences in ages reported upon registration and at endline. These potential covariates were not strongly associated with uptake outcomes and, therefore, were not included in the final model.

[18] Approximate age, based on age when registered on U-Report (updated each calendar year)

High-uptake tribe	Binary	Affiliation with eight tribes having apparent high uptake during campaign: Tonga, Nsenga, Namwanga, Ila, Kunda, Lala, Lamba, Lunda[19] [vs. affiliation with other tribes]
'Verifiability'	Continuous (0-1)	Used for verified uptake outcomes only; controls for client data availability to cross-check reported uptake

7.1.2 Assessing self-reported uptake

Self-reported uptake consisted of a participant responding 'yes' to the question, 'Are you circumcised, meaning that the foreskin was removed from the head of your penis?' Participants who reported being circumcised were asked for site details and the date of the procedure. While most participants reported this information, some chose not to respond or provided uninterpretable responses. Although the data were expected to be partially unreliable due to factors such as lack of seriousness, mistakes, or misinterpretation, uptake was reported at a much higher rate than anticipated. Additionally, responses were more inconsistent than expected, with reports of being uncircumcised despite previous reports of being circumcised.

In the context of uncertain levels of *true* uptake, the analysis aims to identify possible impact in terms of proportional differences in reported uptake across study arms, rather than attempting to estimate true uptake. Progressively stringent outcome criteria enable sensitivity analysis and attempt to control for statistical noise and possible biased reporting (table 7). Two types of restrictions were implemented on top of all self-reported uptake, in any survey.

- *Inconsistency screening:* Any uptake associated with multiple reports that were contradictory in status, site or rough date[20] of uptake were invalidated for the purpose of analysis. By this criteria, participants reporting uptake only once or reporting multiple times but with missing uptake data could not be inconsistent.
- *Consistency requirements:* Beyond looking solely for contradictions in reports, these stricter criteria looked for report details to be actively validated by at least one subsequent report. This analysis necessarily looked at uptake occurring more than two months before the last survey to which the participant had responded, allowing for two reports of circumcision. Uptake reported after the four-month survey could not be registered according to the criteria; participants responding to only one follow-up survey were dropped from the analysis.

[19] These are not necessarily the tribes associated with high uptake in the population at large, and the baseline survey revealed high uptake by other tribes as well.

[20] A 'rough date' match in the study period requires that two-thirds of reports to be within one month of one another (and any third report not more than two months apart), OR that dates of months only align but by no more than two months from one another (e.g. 18 May and 18 July). The 'precise date' criteria requires that dates reported not be more than two days apart.

Three criteria were selected to conduct the primary analysis of self-reported outcomes, chosen to represent the spread of criteria. The alternative analyses further testing the sensitivity of results are presented in appendix E. These criteria were not originally intended to play as prominent a role in the analysis. The study's expanded pre-analysis plan after survey data unreliability emerged early on highlighted criteria #7 (confirmational consistency on status, site and rough date) – only one of the primary analysis models chosen here. The other two analyses (ultimately having weaker findings) were added to capture a broader range of reported uptake, including uptake only reported once, either because of loss-to-follow-up on subsequent surveys or censoring at the end of the six-month follow-up.

Table 7: Criteria used to evaluate self-reported uptake

Restriction type	#	Criteria	# of reports by criteria	% of all reports
No restrictions	1	All reports	441	100%
Inconsistency screening	**2***	**Screen for contradictory statuses**	**262**	**59%**
	3	Screen for contradictory statuses and uptake sites	249	56%
	4*	**Screen for contradictory statuses, sites and rough dates**	**190**	**43%**
Consistency requirements (uptake details must be backed up by later reports)	5	Consistent status required	125	28%
	6	Consistent status and uptake site required	106	24%
	7*	**Consistent status, site, and rough date required**	**46**	**10%**
	8	Consistent status, site, and precise date required	21	5%

Note: Asterisks (*) indicate criteria for primary analysis of self-reported data.

Several alternative sources of uptake data – each with its own limitations – provided an opportunity to compare consistency outcome criteria of self-reported data against uptake measured with much more confidence and reliability (table 8).

Table 8: Sources of uptake data for interpreting reliability of self-reported data

Characteristics of self-reported data		Verified uptake*		Uptake reported to counsellors**		Uptake described in phone interviews***	
		No.	%	No.	%	No.	%
<< Improving Reliability <<	Reported being uncircumcised	--	--	1	2%	1	4%
	Inconsistent: contradictory statuses reported	5	14%	4	9%	0	0%
	Inconsistent: contradictory sites reported	1	3%	7	15%	6	23%
	Insufficient data to judge consistency	7	19%	3	7%	0	0%
	Inconsistent: contradictory rough dates reported	8	19%	10	23%	9	35%
	Fully consistent (status, sites and rough dates)	16	44%	18	42%	10	38%
	TOTAL	**37**	**100%**	**43**	**100%**	**26**	**100%**

Note: * Possible bias due to possibly higher "verifiability" of consistent reports. ** Possible bias due to more engaged/open U-Reporters reporting uptake to counsellors. *** Non-random sample; self-selection bias; fewer participants sought in first place with insufficient data to compare consistency.

In addition to uptake verified with client records, participants could have explicitly indicated uptake through counsellor interaction (e.g. 'I got circumcised today. How long is the pain going to last?') or during the qualitative interview in which uptake details were discussed in-depth. Participants who indicated uptake through one of these sources – verified uptake, uptake reported to counsellors, and uptake described in phone interviews – were more likely (but imperfectly) to have been consistent in reporting uptake across SMS-surveys.

Finally, many participants (at least 348 according to criteria used, or 44 per cent of all enrolled participants reporting uptake at some point) were likely circumcised prior to the campaign despite responding that they were uncircumcised in the baseline survey, evidenced by consistently reported uptake prior to the baseline survey. Interview and activity data backed up these reports. Some of those participants did report uptake between the baseline survey and the VMMC campaign, before which they could not have been affected by the campaign. All participants who reported greater than one-out-of-three uptake dates prior to the campaign launch were deemed ineligible and excluded from the analysis presented in this report.

Table 9: Sources of uptake data for interpreting reliability of self-reported data

Characteristics of self-reported data		Verified uptake*		Uptake reported to counsellors**		Uptake described in phone interviews***	
		No.	%	No.	%	No.	%
<< Improving Reliability <<	Reported being uncircumcised	--	--	1	2%	1	4%
	Inconsistent: contradictory statuses reported	5	14%	4	9%	0	0%
	Inconsistent: contradictory sites reported	1	3%	7	15%	6	23%
	Insufficient data to judge consistency	7	19%	3	7%	0	0%
	Inconsistent: contradictory rough dates reported	8	19%	10	23%	9	35%
	Fully consistent (status, sites and rough dates)	16	44%	18	42%	10	38%
	TOTAL	**37**	**100%**	**43**	**100%**	**26**	**100%**

Note: * Possible bias due to possibly higher "verifiability" of consistent reports. ** Possible bias due to more engaged/open U-Reporters reporting uptake to counsellors. *** Non-random sample; self-selection bias; fewer participants sought in first place with insufficient data to compare consistency.

7.1.3 Assessing verified uptake

Cross-checked self-reported data provide a much more robust indicator of uptake, but the data are limited due to a wide range of possible factors affecting report 'verifiability' and, therefore, likely significantly underestimate actual levels of uptake. These factors include incomplete data from facilities, participants going for circumcision outside of the study area and the limitation of only having the last five digits of the phone number as the main data with which to match participants to clients.[21]

A reported circumcision was considered 'verified' if positive match outcomes (phone number, date, age, neighbourhood) at a reported uptake site had a low probability of occurring by chance (table 10). As with self-reports, reports verified according to the criteria associated with client uptake dates prior to the VMMC campaign are excluded from the analysis.

Table 10: Criteria used to evaluate reports of uptake as verified

#	Criteria*	# of valid reports	% of all self-reports**	% of study sample
1	Probabilistic site and phone match	24	5.4%	(1.5%)

[21] Participants could give wrong or alternative phone numbers when going for VMMC, or the numbers could be recorded incorrectly or illegibly by staff.

Note: * Criteria: site match + five-digit or four-digit phone number match with low probability (less than 1 per cent for five-digit match; less than 0.5 per cent for four digit matches) of all match outcomes occurring by chance alone. ** *All* self-reported uptake.

7.1.4 Sub-sample analyses

The primary outcome regressions were run on sub-samples by self-reported baseline intention (no intention vs. any intention; intention within two months vs. no intention), district (Lusaka vs. Chongwe), and age (less than 18 years vs. 18 years and older).

The study was originally designed to facilitate sub-sample analysis of participants in Chongwe District and non-adults. However, due to relatively low numbers of those participants ultimately enrolled on U-Report in the first place, as well as a small sample frame after the baseline screening survey, the sub-groups of interest are small (9 per cent of the sample is from Chongwe and only 7 per cent are less than 18 years of age), limiting statistical power to glean strong quantitative findings.

7.1.5 Measuring secondary outcomes

The secondary quantitative analysis examines intermediary outcomes that fit into the theory of change. Self-reported VMMC intention at the end of the study is likely associated with future uptake (baseline intention in the study is associated with uptake in the control group), and demand for information – measured by engagements with SMS counsellors – reveals whether U-Report may be filling a gap and engaging participants on the way to influencing behaviour beyond programmed SMS messaging.

Intention is examined through self-reported data with descriptive statistics, difference in differences evaluation, and regression analysis (using the same model used for uptake outcomes). A first analysis looks simply at the proportion of participants reporting some level of intention versus no intention to take account of the most important distinction while controlling for possibly less reliable reports of ‘intention within two months.’ A second analysis evaluates directional changes in reported intention since baseline, with outcomes being the percent of the sample reporting the same level of intention as baseline, greater intention or less intention.

Four possible stages of change were assessed by SMS survey responses (table 11). Reported uptake is treated as an ‘intention’ level in both analyses. Especially due to the high proportion of reported uptake which cannot realistically reflect true uptake during the campaign, reported circumcision is treated as a *higher* level of intention than that within two months.[22]

[22] All participants interviewed who reported being circumcised in SMS surveys but were in fact not circumcised (8 participants) reported active intention to go for VMMC and may have falsely reported uptake to express their intent on a socially desirable behaviour.

Table 11: Intention levels

Stages of change/ intention levels	No intention vs. intention analysis	Directional change in intention analysis
1. No intention	No intention	Base intention
2. Intention at some point	Intention	+ Higher intention
3. Intention within two months	Intention	++ Higher intention
4. Action	Intention	+++ Higher intention

The other secondary outcome – demand for information – is measured through the proportion of participants who engaged counsellors, the number of messages sent to counsellors and the number of study period days on which participants sent messages. The latter outcomes are also measured over time. Besides showing differences between treatment and control arms, descriptive statistics are used to show the absolute degree of U-Report engagement seen during the VMMC campaign, which is highly attributable to the interventions.

7.1.6 Qualitative analysis

Qualitative data came from two rounds of semi-structured interviews as well as messages between participants and counsellors. The exploratory objectives of the qualitative analysis expanded beyond the narrower impact evaluation objectives:

1. Understand the presence and mechanics of the VMMC campaign interventions' potential impact, including possible barriers to impact

2. Reveal campaign weaknesses or routes to improved VMMC promotion via SMS

3. Reveal, explain, or help resolve study weaknesses in detecting VMMC outcomes (discussed throughout report)

Interviews were arranged to ensure U-Reporter confidentiality. First, SMS invitations were sent to participants with instructions and a description of 5.00 ZMW (about US$0.80) airtime compensation for completing 20–30 minute interviews. These invitations asked participants to call in to U-Report's sister talkline and reserve a separate interview time. After receiving an SMS reminder of the interview time, participants were required to call in at the designated time (sometimes multiple times due to network problems). This process put a large onus on potential interviewees, likely leading to strong self-selection bias with more eager/interested or available participants completing the interviews.

Participants were purposively chosen for interview invitations, and many invited participants had reported that they were circumcised. In total, 217 participants were sent interview invitations and 40 semi-structured interviews (18 per cent) were

conducted.[23] Eleven interviewees were in the control group. Thirteen participants were uncircumcised, and of 26 likely-circumcised participants, 14 (53.8 per cent) revealed uptake prior to the study period (one participant's status was unknown). Counsellors asked participants about their experience using U-Report as well as circumcision knowledge, uptake, and intention using the semi-structured questionnaire.

Both qualitative data sources provided valuable and more reliable uptake data compared to SMS survey responses since details could be probed for or volunteered without any prompting. However, both sources provided data from potentially biased, partially self-selected samples. Only 40 interviews were completed, and the interview structure was simple to facilitate counsellor implementation. The data present ideas and perspectives that provide insight around quantitative data without providing resolution around key questions.

7.1.7 Cost-effectiveness analysis

A cost-effectiveness analysis was completed to examine each intervention's at-scale cost per additional circumcision, given an established platform requiring ongoing management costs.

The analysis used a model that measured both the cost and number of circumcisions that would be achieved if all U-Reporters across Zambia were exposed to one of three options that largely mimicked what each evaluation scenario would look like at-scale. The analytic time-horizon for this campaign was six months with 21 campaign messages sent during this time, as was done in the campaigns evaluated in this report. Probabilities that were used in the model were largely based on evaluation point-estimates, though they were not statistically significant. We used the societal perspective, which included operational costs, as well as costs for transportation and the VMMC procedure, itself. We did not include other costs that individuals may incur like lost wages.

The complete analysis, including methodology specifications and inputs is found in appendix F.

7.2 Findings: sample outcomes

There were 2,312 U-Reporters initially enrolled into the evaluation. However, after accounting for attrition and dropping participants who revealed ineligibility, the final study sample was 1,652 (see section 6.2).[24]

Table 12 presents sample characteristics and variables of interest, which were similar across study arms. Participants who failed to respond to surveys or were otherwise dropped from the analysis were also similar across arms based on limited dimensions available (data not shown).

[23] Two additional interviews were conducted with presumed non-study participants. The callers were female.

[24] Some analyses presented use different samples, depending on missing data.

To keep SMS surveys as short as possible, participants within each study arm were randomly designated to receive a single question in each follow-up survey on education, relationship status or circumcised family members. Therefore the data were collected at different points but were unbiased across arms.[25] More importantly, non-response rates led to 21–31 per cent of data to be missing for those questions after also accounting for unclear responses.

Generally, participants were from Lusaka (92 per cent) and were between the ages of 18 and 27 (85 per cent). A high proportion (38 per cent) of respondents over the age of eighteen who provided interpretable responses said they had started or completed college, and only 11 per cent had not completed high school. Roughly half of those who responded with their relationship status (52 per cent) said they were either in a relationship or married. A high proportion of respondents (44 per cent) reported having a brother who was circumcised, and 13 per cent had a circumcised father that they were aware of, suggesting high family acceptability of circumcision. Only 19 per cent of respondents said they had no circumcised father or brothers, but 32 per cent said they were 'not sure.'

[25] There is no evidence of treatment arm effects on reporting of data incorporated into model covariates, and possible chains of causality (e.g. being convinced to go for VMMC and taking a brother along) are weak. Only circumcised family members showed significant association with uptake outcomes and was used in the analyses presented here.

Table 12: Sample characteristics

	Study arm							
	Control (N=550)		Conventional (N=569)		Tailored (N=533)		Total (N=1,652)	
	No.	%	No.	%	No.	%	No.	%
Age								
Less than 18*	36	(7%)	34	(6%)	39	(7%)	109	(7%)
18 to 22	268	(49%)	282	(50%)	279	(52%)	829	(50%)
23 to 27	200	(36%)	198	(35%)	177	(33%)	575	(35%)
28 to 30	46	(8%)	55	(10%)	38	(7%)	139	(8%)
District								
Lusaka	502	(91%)	521	(92%)	490	(92%)	1,513	(92%)
Chongwe*	48	(9%)	48	(8%)	43	(8%)	139	(8%)
Baseline VMMC intention								
No intention (or 'not sure')	245	(45%)	234	(41%)	243	(46%)	722	(44%)
At some point	122	(22%)	156	(27%)	118	(22%)	396	(24%)
Within two months*	178	(32%)	167	(29%)	163	(31%)	508	(31%)
Data missing	5	(1%)	12	(2%)	9	(2%)	26	(2%)
Education (participants 19 years+ only)								
No high school	61	(11%)	70	(12%)	78	(15%)	209	(13%)
High school (complete)	170	(31%)	167	(29%)	157	(30%)	494	(30%)
College (started)	149	(27%)	166	(29%)	117	(22%)	432	(26%)
Data missing	170	(31%)	166	(29%)	181	(34%)	517	(31%)
Relationship status								
Single	195	(36%)	218	(38%)	209	(39%)	622	(38%)
In relationship	184	(34%)	190	(33%)	174	(33%)	548	(33%)
Married	51	(9%)	41	(7%)	37	(7%)	129	(8%)
Data missing	120	(22%)	120	(21%)	113	(21%)	353	(21%)
Circumcised family members								
Father & brother(s)	28	(5%)	37	(7%)	37	(7%)	102	(6%)
Father	18	(3%)	15	(3%)	31	(6%)	64	(4%)
Brother(s)	156	(28%)	146	(26%)	141	(27%)	443	(27%)
None	84	(15%)	83	(15%)	72	(14%)	239	(15%)
Unsure	129	(24%)	143	(25%)	122	(23%)	394	(24%)
Data missing	135	(25%)	145	(26%)	130	(24%)	410	(25%)

Note: Chi squared tests did not reveal any statistically significant differences across data categories (p-values not shown). * Stratification variables for study arm assignments and sub-sample analysis.

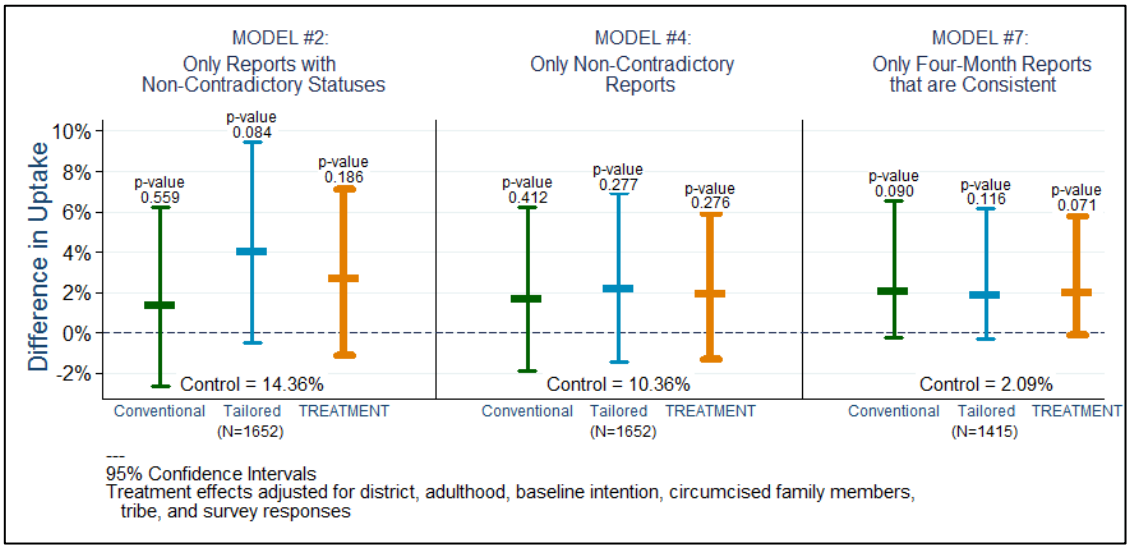
At baseline, a high percentage of final sample participants appeared to have decided to go for VMMC or were at least open to the idea. Only 18 per cent of the sample stated no intention to go for VMMC (another 26 per cent were 'not sure'). While the high percentage of respondents expressing intention to go for VMMC within two months (33 per cent) clearly would not translate into uptake at that level, the responses likely indicate *strong* intention and possibly active plans to go in the near future (whether ultimately realised or not).

7.3 Findings: self-reported outcomes

From the strictest self-reported outcome criteria to the most lenient, uptake ranged from 1.5–25.1 per cent of the total sample, and percentage point differences in the proportion of uptake between treatment arms and the control arm ranged from 0.3–6.3 percentage points(figure 8 and tables 13 and 14). The null hypothesis – that the intervention conditions did not affect uptake – could not be rejected in any of the three primary analyses, and outcomes were only *indicative* of likely but uncertain positive impact.[26] Odds ratios measuring the impact of the conventional campaign ranged from 11 per cent to 99 per cent greater odds of getting circumcised compared to the control group. Odds ratios measuring the impact of the tailored campaign ranged from 24 per cent to 90 per cent greater odds of getting circumcised. The odds of self-reported circumcision were higher among participants in both treatment arms according to each criterion, but the odds ratio was only statistically significant in one non-primary regression model for the tailored campaign with no restrictive criteria (model 1 in appendix E). That model found a 47 per cent greater odds (95% CI: 1.09, 1.99, p-value <0.01) of self-reported uptake of circumcision among participants in the tailored campaign compared with those in the control arm. Aggregated conventional and tailored treatment effects were also positive in association, but non-statistically significant with p-values ranging from 0.071 to 0.276 (figure 8).

Point estimates for the tailored arm outperformed those for the conventional arm in most analyses (except for the strictest criteria, models 7–8), although differences in uptake were negligible when stricter outcome criteria were used. Again, none of these differences were statistically significant.

Figure 8: Impact of interventions on VMMC uptake (self-reported outcomes)



[26] None of the arms showed statistically significant uptake against the control in the bivariate model, as well.

Table 13: Uptake by study arm for self-reported data (primary criteria)

Study arms	No status-inconsistency (N=1,652)			No inconsistency (status, site or date) (N=1,652)			Consistent status, site and rough date (N=1,415)*		
	No.	%	dif	No.	%	dif	No.	%	dif
Control	79	14.4%	--	57	10.4%	--	10	2.10%	--
Conventional	86	15.1%	+0.7%	66	11.6%	+1.2%	18	3.70%	+1.6%
Tailored	97	18.2%	+3.8%	67	12.6%	+2.2%	18	4.00%	+1.9%

Table 14: Logistic regression results for self-reported data (primary criteria)

Covariates	**MODEL #2 No status-inconsistency** (N=1,652)			**MODEL #4 No inconsistency (status, site or date)** (N=1,652)			**MODEL #7^{P} Consistent status, site and rough date (four-month data)** (N=1,415)*		
	Odds ratio	**p-value**	**[95% CI]**	**Odds ratio**	**p-value**	**[95% CI]**	**Odds ratio**	**p-value**	**[95% CI]**
Study arm									
Control	*Ref*			*Ref*			*Ref*		
Conventional	1.11	0.56	[0.79,1.55]	1.17	0.41	[0.80,1.72]	1.99	0.09	[0.90,4.42]
Tailored	1.34	0.08	[0.96,1.86]	1.24	0.28	[0.84,1.81]	1.90	0.12	[0.85,4.21]
Stratifying covariates									
Two-month intention	2.11	**<0.01**	[1.60,2.77]	1.95	**<0.01**	[1.43,2.66]	1.91	**0.04**	[1.04,3.49]
Adult	1.21	0.52	[0.67,2.18]	0.99	0.97	[0.53,1.85]	3.14	0.26	[0.42,23.4]
Chongwe District	1.46	0.09	[0.94,2.27]	1.56	0.07	[0.97,2.52]	1.99	0.12	[0.84,4.73]
Other covariates									
Circumcised family members	1.60	**<0.01**	[1.21,2.13]	1.50	**0.02**	[1.08,2.08]	2.87	**<0.01**	[1.51,5.48]
High-uptake tribe	1.42	**0.02**	[1.05,1.93]	1.43	**0.04**	[1.01,2.02]	2.97	**<0.01**	[1.62,5.46]
No. of surveys responded	0.86	0.11	[0.71,1.04]	0.67	**<0.01**	[0.55,0.82]	1.26	0.53	[0.61,2.64]
Constant	0.13	**<0.01**	[0.05,0.31]	0.26	**0.00**	[0.10,0.66]	0.00	**<0.01**	[0.00,0.03]

Note: * All participants reporting uptake prior to campaign period dropped from analysis

The following section discusses possible issues of bias, with the most important question pertaining to the presence of more bias in treatment arms. The strict criteria likely help control for some potential bias, making these results valuable alongside verified results (which underestimate uptake due to verifiability issues and have a smaller sample).

7.4 Findings: verified outcomes

Based on the criteria for verified uptake, 24 of 441 (5.4 per cent) self-reports were verified using client data in the study period, making it difficult to strongly assess the potential impact of the two interventions (tables 15 and 16). The multivariate logistic regression results found a 34 per cent higher odds (95% CI: 0.45, 4.02, p-value=0.60) of verified uptake among participants in the conventional arm compared to those in the control arm and a 33 per cent lower odds (95% CI: 0.20, 2.23, p-value=0.51) among participants in the tailored arm, compared with those in the control arm.

Table 15: Uptake by study arm for verified criteria

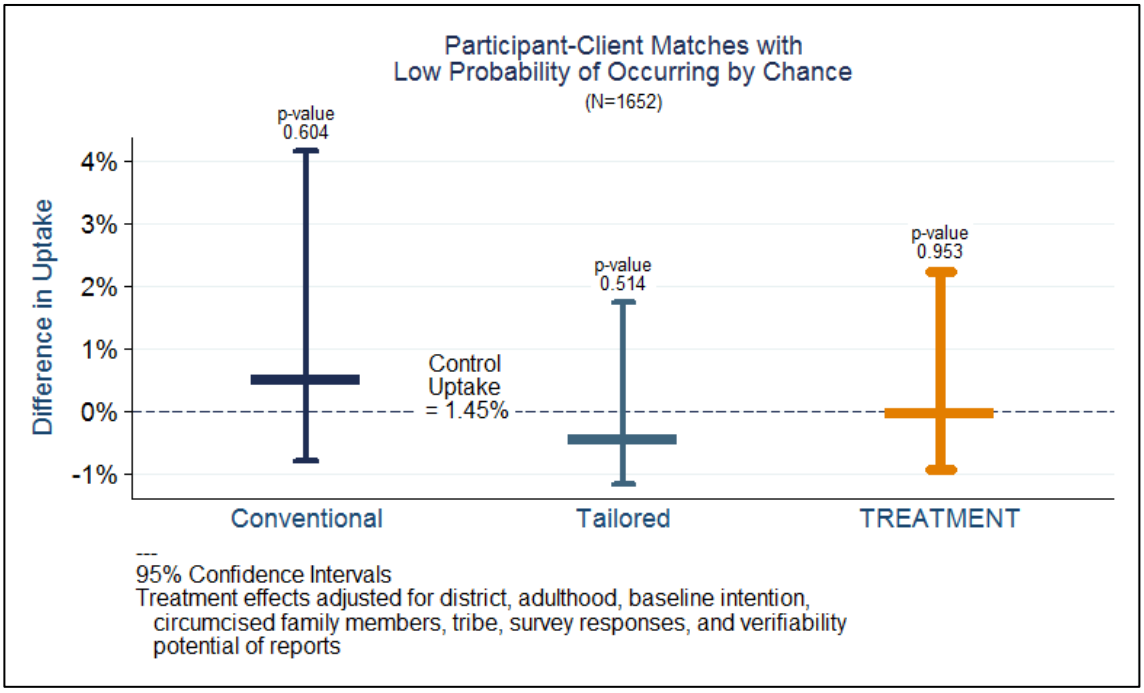
Study arms	**Verified uptake (N=1,652)**		
	No.	%	dif
Control	8	1.5%	--
Conventional	10	1.8%	+0.3%
Tailored	6	1.1%	-0.4%

Table 16: Logistic regression results for verified criteria

	Verification criteria		
	Probabilistic participant-client match (N=1,652)		
Covariates	**Odds ratio**	**p-value**	**[95% CI]**
Study arm			
Control	*Ref*		
Conventional	1.34	0.60	[0.45,4.02]
Tailored	0.67	0.51	[0.20,2.23]
Stratifying covariates			
Two-month intention	0.87	0.78	[0.34,2.23]
Adult	1.36	0.78	[0.16,11.7]
Chongwe District	1.05	0.95	[0.21,5.16]
Other covariates			
Circumcised family Members	0.94	0.90	[0.36,2.49]
High-uptake tribe	4.71	**<0.01**	[1.79,12.4]
No. of surveys responded	1.92	0.21	[0.69,5.36]
Verifiability	359	**<0.01**	[64.2,2009]
Constant	0.00	**<0.01**	[0.00,0.00]

As with self-reported data, differences in verified uptake by treatment arm versus the control arm were not statistically significant, whether controlling for covariates or otherwise. Unlike with self-reported outcomes, though, the point estimates were *not* indicative of impact as shown in figure 9, with point estimates within 0.5 per cent of the control group uptake level and p-values for the conventional arm and 0.51 for the tailored arms. The point estimate for the magnitude difference between aggregated treatment and control uptake was 0.0 percentage point (95% CI: -0.92%, 2.23%, p-value=0.95).

Figure 9: Impact of interventions on VMMC uptake (verified data)



7.5 Sub-sample analysis

As outlined in the pre-analysis plan, we examined impact for each sub-sample by baseline level of intention to go for VMMC, district and adulthood. We did not formally test for heterogeneous treatment effects. Instead, we ran separate logistic regressions on verified and self-reported outcomes (model 4: non-inconsistency self-reported outcomes) for each sub-group. The small number of verified outcomes, however, often limited the extent to which strong conclusions could be drawn.

7.5.1 Baseline intention

We found mixed evidence on differential impact across participants with different baseline levels of intention (tables 17 and 18). There was little evidence in terms of verified data, although the conventional arm showed a statistically significant positive impact on uptake among participants reporting intention to go for VMMC within two months at baseline (p-value=0.04). While this is important to note, this evidence is not well-corroborated by other analyses or by evidence from the similar tailored arm.

Interestingly, although in terms of self-reported outcomes only, a greater proportion of treatment arm participants with no two-month intention reported going for VMMC compared against the control arm, and these differences were statistically significant (p-value=0.03 in convention arm; p-value=0.01 in tailored arm). The opposite association was found with participants reporting two-month intention, although those differences were not statistically significant. One hypothesis regarding the tailored arm was that it would be more successful at pushing participants with high intention levels to action, but control and conventional participants out-performed in that intention category. If the indications of self-reported outcomes are correct, then the SMS campaigns may have had more utility in getting additional participants with lower levels of intention to go for VMMC. It could also indicate that participants with strong intention to go but have not yet gone face larger barriers that were not addressed by an information-based intervention.

Table 17: Sub-sample analysis: no intention within two months at baseline

Study arm	**No Intention within 2 months (N=1,144)**				
	# of outcomes	**% of total**	**Regression results[a]**		
			Odds ratio	**[95% CI]**	**p-value**
	Non-inconsistent self-reported uptake				
Control	22	5.91%	*Ref*		
Conventional	40	9.95%	1.83	[1.06,3.15]	**0.03**
Tailored	43	11.62%	2.04	[1.19,3.50]	**0.01**
	Verified uptake				
Control	6	1.61%	*Ref*		
Conventional	2	0.50%	0.32	[0.06,1.64]	0.17
Tailored	5	1.35%	0.84	[0.25,2.86]	0.78

Note: [a] Adjusted for adulthood, district, circumcised family member, tribe and the number of survey responses

Table 18: Sub-sample analysis: intention within two months at baseline

Study arm	**Intention within 2 months (N=508)**				
	# of outcomes	**% of total**	**Regression results[a]**		
			Odds ratio	**[95% CI]**	**p-value**
	Non-inconsistent self-reported uptake				
Control	35	19.66%	*Ref*		
Conventional	26	15.57%	0.74	[0.42,1.30]	0.29
Tailored	24	14.72%	0.70	[0.39,1.25]	0.23
	Verified uptake				
Control	2	1.12%	*Ref*		
Conventional	8	4.79%	5.20	[1.04,25.89]	**0.04**
Tailored	1	0.61%	0.52	[0.05,5.84]	0.59

Note: [a] Adjusted for adulthood, circumcised family member, tribe and the number of survey responses

7.5.2 District

No clear differential impacts were seen across districts (tables 19 and 20). The verified outcomes for Chongwe are not strongly comparable against those of Lusaka since the outcomes there are all associated with a single central clinic at which confounding factors could have uniquely affected verifiability compared against the range of verifiability across Lusaka's many clinics. It is interesting to note that a higher overall proportion of participants in Chongwe reported going for VMMC in the study period.

Table 19: Sub-sample analysis: Lusaka District

Study arm	Lusaka (N=1,513)				
	# of outcomes	% of total	Regression results[a] Odds ratio	[95% CI]	P-value
	Non-inconsistent self-reported uptake				
Control	48	9.56%	*Ref*		
Conventional	58	11.13%	1.24	[0.82,1.87]	0.31
Tailored	60	12.24%	1.31	[0.87,1.97]	0.19
	Verified uptake				
Control	8	1.59%	*Ref*		
Conventional	10	1.92%	1.37	[0.53,3.56]	0.52
Tailored	4	0.82%	0.51	[0.15,1.71]	0.27

Note: [a] Adjusted for adulthood, 2-month intent, circumcised family member, tribe and the number of survey responses

Table 20: Sub-sample analysis: Chongwe District

Study arm	Chongwe (N=139)				
	# of outcomes	% of total	Regression results[a] Odds ratio	[95% CI]	P-value
	Non-inconsistent self-reported uptake				
Control	9	18.75%	*Ref*		
Conventional	8	16.67%	0.96	[0.31,2.92]	0.94
Tailored	7	16.28%	0.93	[0.29,3.00]	0.91
	Verified uptake				
Control	0	0.00%	n/a[b]		
Conventional	0	0.00%			
Tailored	2	4.65%			

Note: [a] Adjusted for adulthood, 2-month intent, circumcised family member, tribe and the number of survey responses. [b] No outcomes - Regression not done

7.5.3 Age

There was no clear evidence of differential impact across participants under 18 years of age and those who were 18 and over (tables 21 and 22). All participants interviewed were at least 18 years old, but many younger participants still in school reported barriers to uptake during the study period associated with schooling.

Table 21: Sub-sample analysis: younger than 18 years

Study arm	Younger than 18 years (N=109)				
	# of outcomes	% of total	Regression results[a] Odds ratio	[95% CI]	P-value
	Non-inconsistent self-reported uptake				
Control	4	11.11%	*Ref*		
Conventional	3	8.82%	1.16	[0.21,6.53]	0.87
Tailored	5	12.82%	1.60	[0.34,7.60]	0.56
	Verified uptake				
Control	0	0.00%	n/a[b]		
Conventional	1	2.94%			
Tailored	0	0.00%			

Note: [a] Adjusted for district, 2-month intent, circumcised family member, tribe and the number of survey responses. [b] No outcomes - Regression not done

Table 22: Sub-sample analysis: 18 years and older

Study arm	18 years and older (N=1,543)				
	# of outcomes	% of total	Regression results[a] Odds ratio	[95% CI]	P-value
	Non-inconsistent self-reported uptake				
Control	53	10.31%	*Ref*		
Conventional	63	11.78%	1.19	[0.81,1.77]	0.38
Tailored	62	12.55%	1.24	[0.84,1.84]	0.28
	Verified uptake				
Control	8	1.56%	*Ref*		
Conventional	9	1.68%	1.20	[0.45,3.17]	0.72
Tailored	6	1.21%	0.78	[0.27,2.30]	0.66

Note: [a] Adjusted for district, 2-month intent, circumcised family member, tribe and the number of survey responses

7.6 Secondary outcome findings

7.6.1 VMMC intention

Across all study arms, more participants reported higher intention to go for VMMC by the end of the study than they reported at baseline (table 23).[27] Participants in the tailored arm demonstrated a statistically significant change (p-value <0.01) in reported intention compared to the control arm (table 24). While 46 per cent of tailored arm participants reported no intention to go for VMMC at baseline, more than half of those participants

[27] Intention was not necessarily measured after six months, since some participants did not respond to the six month survey. Participants' latest reports were used as outcomes in this analysis. Responses for each survey were controlled for in regression analysis.

reported some level of intention to go for VMMC by the end of the study, representing a difference of 20 percentage points.

Table 23: Participants reporting intention to go for VMMC

Study arm		VMMC intention at baseline	VMMC intention at last report	Change from baseline (PP)	Dif in Difs (PP)	p-value
Control	(n=543)	55.3%	65.4%	+10.1	--	
Conventional	(n=557)	58.0%	70.4%	+12.4	+2.3	0.08
Tailored	(n=522)	53.8%	74.1%	+20.3	+10.2	**<0.01**

Note: PP for percentage points

Table 24: Logistic regression results for intention to go for VMMC

Covariates	Intention to go for VMMC (N-1,622) Odds ratio	p-value	[95% CI]
Study arm			
Control	ref		
Conventional	1.29	0.08	[0.97,1.72]
Tailored	1.76	**<0.01**	[1.31,2.38]
Stratifying covariates			
Adult (18yrs or older)	1.13	0.61	[0.70,1.83]
Residence in Chongwe District	1.49	**<0.01**	[1.14,1.94]
Other covariates			
Baseline intention (any)	7.70	**<0.01**	[5.99,9.91]
Circumcised family members	1.49	**<0.01**	[1.14,1.94]
2 month survey completed	0.30	**<0.01**	[0.17,0.53]
4 month survey completed	0.31	**<0.01**	[0.18,0.55]
6 month survey completed	0.29	**<0.01**	[0.17,0.51]
No. of surveys responded to	3.03	**<0.01**	[1.81,5.09]
Constant	0.21	**<0.01**	[0.08,0.51]

Uptake data alone do not preclude the possibility that the interventions had a negative effect on uptake. Primary avenues for negative impact could be the interventions either providing information that scares or turns off participants from VMMC or causing participants to retrench, possibly by pushing too hard and also turning them off to the idea. However, indication of negative impact would likely be revealed in intention data, since negative responses to intention questions are an easy way to emphasise dissatisfaction (another option, non-response to surveys, is not strongly associated with treatment conditions).

Table 25 shows that more participants across all study arms reported increased rather than decreased intention. However, fewer treatment arm participants reported decreased intention over the course of the study than in the control arm, and more reported

increased intention (p-values for net change in uptake are 0.14 and <0.01 for the conventional and tailored arms, respectively).

Table 25: Changes in reported VMMC intention from baseline

Study arm		Decreased intention	Same intention	Increased intention	Total
Control	(n=611)	11.3%	56.1%	32.6%	100%
Conventional	(n=611)	9.8%	53.7%	36.5%	100%
Tailored	(n=601)	7.7%	49.3%	43.1%	100%

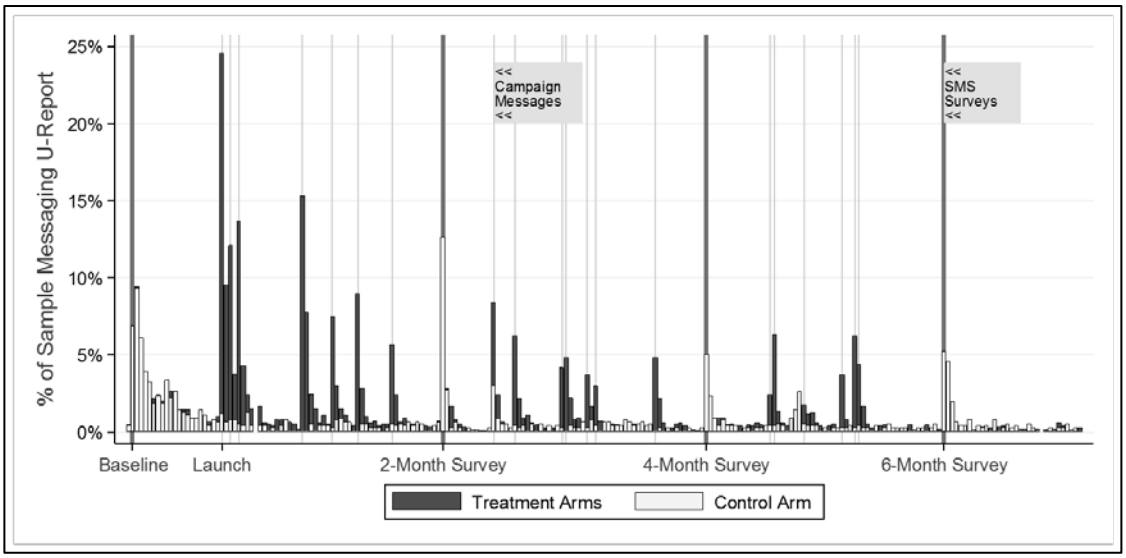
Diff in diffs (Changes vs. control)	Decreased intention (PP)	Same intention (PP)	Increased intention (PP)	p-value
Conventional	-1.5	-2.5	+3.9	0.14
Tailored	-3.6	-6.9	+10.5	**<0.01**

Note: Last reported intention level used to compare against baseline; PP for percentage points

7.6.2 Demand for information

The campaigns revealed high demand for information on VMMC, as measured by the proxy of questions sent to counsellors (largely but not exclusively about VMMC and related topics to campaign messages). High engagement at the campaign's outset by participants receiving messages did fade over time. While almost 25 per cent of treatment-arm participants messaged U-Report after receiving their first promotional message, most campaign messages sent by U-Report yielded less than 5 per cent response rate from participants three months into the campaign (figure 10).

Figure 10: Participants sending messages over the course of the survey



Despite contaminating surveys which prompted control group participants to engage with U-Report (see section 8), a significantly higher proportion of treatment arm participants engaged with U-Report over the course of the study (table 26). Outside of the immediate

periods after SMS surveys, over half of participants in one of the treatment arms sent questions to counsellors over the course of the campaign, against 15 per cent in the control arm. About 20 per cent of treatment arm participants engaged U-Report on at least five separate occasions.

Table 26: Interaction with U-Report, 7 May to 22 October 2014 (study period)

	Study arm							
	Control (n=669)		Conventional (n=675)			Tailored (n=656)		
	No.	%	No.	%	p-value*	No.	%	p-value*
U-Report engagement								
At any point	275	36%	555	72%	**<0.01**	558	72%	**<0.01**
	114	15%	399	52%	**<0.01**	413	54%	**<0.01**
Outside SMS survey periods								
# of days engaged								
2+ days	143	19%	413	54%	**<0.01**	428	56%	**<0.01**
5+ days	41	5%	145	19%	**<0.01**	173	22%	**<0.01**
10+ days	10	1%	39	5%	**<0.01**	62	8%	**<0.01**
15+ days	4	1%	9	1%	0.18	9	1%	0.18
# of messages to counsellors								
2+ messages	161	21%	432	56%	**<0.01**	441	57%	**<0.01**
5+ messages	57	7%	188	24%	**<0.01**	213	28%	**<0.01**
10+ messages	21	3%	64	8%	**<0.01**	97	13%	**<0.01**
20+ messages	7	1%	8	1%	0.80	17	2%	**0.05**

Note: * P-values calculated using bivariate logistic regressions with engagement conditions as the dependent variable and study arms as independent variables. The control group was the reference category for each variable.

Importantly, U-Report engagement versus no engagement was only weakly – and non-significantly – associated with verified or reported VMMC uptake, and only within treatment arms. Participants responding to campaign messages, versus non-responders, had 13 per cent greater odds of reporting non-contradictory uptake (self-reported uptake, model 4; p-value=0.509), and had 10 per cent greater odds of verified uptake (p-value=0.825). There was no relationship between the magnitude of engagement (either number of messages or days) and reported or verified uptake.

7.6.3 Qualitative findings regarding uptake

Although it is difficult to ascertain the true role of U-Report in participants' decisions to go for VMMC through anecdotal evidence, two conventional arm participants affiliated with

the University of Zambia (out of nine treatment group interviewees providing strong evidence of uptake during the campaign period) did explain that U-Report played key roles in their decisions to go for VMMC before being prompted by interviewers (figures 11 and 12). Notably, both participants cited counsellor interaction as a critical factor, and neither reported intention to go for VMMC in the baseline survey (the first said 'not sure'). This first interviewee described lack of confidence as a barrier to uptake, and a second cited 'misconceptions' (presumably informational) as a barrier.

Figure 11: Interview snapshot 1 – key role of U-Report for VMMC uptake

Study arm: Conventional

Profile: Male, 24, University of Zambia

Baseline intention: 'Not Sure'

VMMC uptake: Confirmed circumcised, probably in August

Has a U-Report counselor in any way helped you to make a decision? 'Yes, absolutely, there were some things that hindered me from doing things but due to the coming of U-Report I was able to ask questions of which they answered me and I was able to make decisions … The best example can be about male circumcision I am talking about … Yes the best example I can give is male circumcision, I had a lot of things that hindered me from going for MC but after talking to U-Report counselors I was confident to go for male circumcision'

Do the messages apply to you? 'They do apply to me like I said I now made the decision to go for male circumcision and as such they apply because they help me make an informed decision'

Do you ever talk to your friends, family, or partner about the messages you receive? 'Okay the first example is in reference to male circumcision. Most of my friends had a negative attitude about male circumcision like I did so because of my interaction with U-Report I was able to talk to them and they made up their minds to go for male circumcision as they have learnt about its importance'

When did you decide that you wanted to go for MC? 'That was after being satisfied with the responses to the questions I had'

Note: ** This report was backed up by SMS dialogue with counselors

Figure 12: Interview snapshot 2 – key role of U-Report for VMMC uptake

Study arm: Conventional

Profile: Male, 27, University of Zambia

Baseline intention: 'No Intention'

VMMC uptake: Confirmed circumcised in August

How satisfied are you with U-Report? 'I can say I am quite satisfied with U-Report because through their text messages and updates they prompted me to go for male circumcision as they could share with me about the advantages and disadvantages and this cleared the misconceptions I had'

Have you ever texted a question? 'Recently, especially the time I went for male circumcision I had a very painful moment so I used to communicate with the counselor and it was like one-on-one communication'

Did U-Report ever help you to make a decision in your life? 'I think they have because before making a decision to go for male circumcision, I had to ask questions through text messages and through that I was able to make a decision'

When did you first decide you wanted to go for MC? 'It was in the same month of August that I started receiving information in details about the advantages of male circumcision from U-Report … I sent a message asking about MC and the response I got cleared the misconceptions people have about male circumcision'

Many treatment arm participants (and some control arm participants) asked questions to counsellors about VMMC and subsequently provided strong indication that they had gone for VMMC. In the majority of these counsellor interactions, there were no strong suggestions of causality. However, figure 13 shows one set of SMS interactions over several months where a conventional arm participant claimed that campaign messages (not counsellor interactions) convinced him to go for VMMC, later attributing his uptake specifically to U-Report. Although the participant received information about a clinic offering VMMC from a counsellor, he later reported going to a different site.

Figure 13: Counselling snapshot – key role of U-Report for VMMC uptake

Study arm: Conventional

Profile: Male, 25, Kalingalinga

Baseline intention: 'Not Sure'

VMMC uptake: Confirmed circumcised in July

U-Reporter	U-Report Counselor
Dofs MC hav any disadvantages?	Yes. once done it cant be reversed
Campaign messages …	
Ok! [guys] u hav [succeeded], am in massmedia so wher is de nearest and safest place i cn do [MC] [from]?	
You can visit Kalingalinga which operates every Tuesday from 08:00am, you can make booking at site anytime	
Thanx,jus worried abt the healing period.Infact its the main thing thats been holding me back.	
U r welcome.Don`t worry as da wound heals completely in 6 weeks.	
SMS survey …	
YES.Am planing to do so especialy over the coming long weekend its just bcoz of my schedule,am woried abt staying home for long.	
Campaign messages …	
Thanx counsellor,i did go 4 MC 2 wiks ago thanks 2 u.Am in the healing process now.	
You are well come.remember that the healing process is 6 weeks.	
Ofcourse i wil,infact i'll evn extend it to 1 year.	
Hahaha, nice one.	

The evaluation's limited qualitative data suggest that U-Report more often played a modest role, and most of the treatment group interviewees reporting uptake did not cite U-Report as a key influencer. However, only two suggested that they went for VMMC completely independently of U-Report. The remaining five interviewees with confirmed uptake cited more minor roles of U-Report, especially in providing what they saw as valuable encouragement and confidence-building for decisions that were likely made independently of U-Report. For example, two participants were motivated by their wives in order to help prevent cervical cancer. After discussing with his wife, one said, 'I asked [U-Report] and they encouraged me to go.' After hearing the first lady of Zambia talk about cervical cancer, another 'thought about [VMMC] for about a month' before 'deciding to go one day' – 'Yes, [U-Report played a role], especially when they said MC is done by professionals when I asked the U-Report counsellor.' Based on the data, the U-Report campaigns could have 'nudged' participants already thinking about VMMC.

Many U-Reporters messaged counsellors about what the VMMC procedure would entail after apparently making a decision to go without counsellor support. Similarly, many participants engaged counsellors only after they had gone for VMMC, asking for information on bearing pain, healing time, and sexual activity. In this way, U-Report may have played a useful role for participants without necessarily influencing uptake itself.

U-Report did appear to play a role in linking participants to health centres offering VMMC, including for some control arm participants. However, those participants may have found sites without that support. Some site recommendations also went apparently unheeded, as participants later reported going to different sites in SMS surveys.

7.6.4 Qualitative findings regarding intention

Of 10 treatment group participants interviewed who were uncircumcised and had intention to go for VMMC, four cited U-Report as instrumental in their decision to want to go for VMMC, claiming that they decided to go for VMMC after receiving messages. One participant expressed intention but was still 'battling' with his decision and was partially convinced by talking to friends, as well. He said he did not take messages from U-Report seriously at first but that persistence made him consider the idea. Two of the other participants claiming that U-Report convinced them contradicted prior baseline survey responses in which they had already stated intention.

Three others cited vaguer ways in which U-Report influenced their intention to go for VMMC alongside more decisive factors, such as being convinced by friends. Most commonly, the participants said U-Report played an important role by providing encouragement as well as new information.

7.6.5 Other qualitative findings

All participants interviewed were generally knowledgeable about circumcision – what it was, some of its general benefits, and at least one clinic that provided it. There were no clear differences in basic knowledge and awareness across study arms. This suggests that potential utility in SMS messaging largely lies in pushing and prompting participants rather than just addressing information barriers. However, participants had different interpretations of healing time and sometimes did not know the degree of protection it provided. One HIV-positive participant said he became interested in circumcision after talking with a friend, but he did not know that he could go for VMMC until he learned from U-Report that anyone could go. However, he appeared to be misled in believing that circumcision would help avoid *passing on* STIs to his partner.

Interviewees appreciated the VMMC messages they received. Compared to other sources of information such as billboards or radio ads, they said SMS was good because it was more personal and direct. U-Report also provided an avenue to ask questions rather than just receiving information passively. One participant said the language of messages should be more informal and relevant to youth. Several interviewees, on the other hand, discussed the messages being 'shallow' or insufficient, saying that other interactive opportunities would be valuable, either in the form of direct lines to counsellors or forums with other U-Reporters. Most interviewed participants expressed intention or had already gone for VMMC, but even a U-Reporter who said he would not go for VMMC said he nevertheless appreciated the campaign.

Most participants complained about the long response time by counsellors and the U-Report system, with several saying they were put off by never receiving responses to their questions. On the other hand, interviewees ultimately saw the counsellors as very

valuable or integral to U-Report, and participants who were circumcised cited the counsellors' role in the decision-making process. Most people also expressed satisfaction with the responses to questions they received, but a few participants said that answers could be 'poor quality,' 'too general' or 'not detailed.'

7.7 Cost-effectiveness analysis

The total setup cost for programming the U-Report platform is US$161,717. On average, U-Report costs US$195,370 to operate annually, excluding the salary for a programmer. (The programmer salary was accounted for in the model for specific campaign activities.) When using the impact estimates from the self-reported outcomes, there would be an expected 1,695 new VMMCs over a six month period without any campaign at all (table 27). Under a tailored campaign scenario sent to all male U-Reporters, there would be an expected 1,923 new circumcisions, resulting in an increase of 228 circumcisions over the control group. Under a conventional campaign scenario, there would be 1,890 new circumcisions, an increase of 196 new circumcisions. Using estimates from verified outcomes, the control scenario would result in 244 new circumcisions over six months compared to 270 in a tailored scenario and 293 in a conventional scenario. This would be an increase of 26 and 49 new circumcisions under the tailored and conventional arms, respectively.

Six months of running U-Report plus additional U-Report engagement would be around US$99,000.[28] After accounting for costs of transport to the facility and the cost of the procedure alone, total costs without any VMMC campaign would be US$237,588. A conventional campaign scenario would cost US$274,303, while a tailored campaign scenario would cost US$278,130. The incremental cost-effectiveness ratio (ICER) accounts for the incremental cost per additional circumcision in each campaign scenario. Assuming that the self-reported effectiveness point estimate represents an upper bound and verified effectiveness represents a lower bound, the ICER of a tailored campaign ranges from US$177.74–920.48 per additional circumcision, while the conventional campaign ranges from US$187.78–505.40 per additional circumcision. This cost is largely driven by the cost of the circumcision procedure alone.

Table 27: Cost-effectiveness results: VMMC campaigns from scratch on an existing platform

Outcomes	Study arms	Self-reported			Verified		
		Total cost (US$)	New circum-cisions	Cost (US$)/ circum-cision	Total cost (US$)	New circum-cisions	Cost (US$)/ circum-cision
	Tailored	278,132.90	1,923	144.66	142,813.46	270	1,028.31

[28] Operational costs for U-Report over six months were included in the total cost estimates, despite the fact that U-Report does not solely operate for VMMC demand generation. However, it was not possible to break out the proportion of costs that were only dedicated to the VMMC campaign activities. These operational costs cancel out in the incremental cost calculations, since they are equivalent across the three scenarios.

	Convent.	274,303.33	1,890	145.13	143,521.22	293	935.27
	Control	237,588.11	1,695	140.21	118,816.61	244	972.10
Impact	**Arm v. control**	**Increment. cost (US$)**	**Increment. # of new circum-cisions**	**ICER**	**Increment. cost (US$)**	**Increment. # of new circum-cisions**	**ICER**
	Tailored	40,544.79	228	177.74	23,996.85	26	920.48
	Convent.	36,715.22	196	187.78	24,704.62	49	505.40

This analysis has several limitations. For one, it assumes that everyone on the U-Report platform is a unique individual. However, it is likely that there are individuals with more than one phone number registered on U-Report. Additionally, it is possible that a portion of the registered numbers is no longer active and, therefore, cannot experience an outcome. Finally, it assumes that non-respondents who receive campaign messages, respondents who live outside of Lusaka or Chongwe, and respondents outside of the 15–30 age range have similar baseline circumcision rates and would experience similar uptake rates to those detected in the evaluation. Each of these assumptions is likely to overestimate the impact (but not the cost) of the campaign scenarios.

This analysis, however, does not account for positive spillovers to non-U-Reporters. Nor does it account for the considerable societal savings of fewer HIV infections that will result from higher numbers of men getting circumcised. These factors would result in more favourable cost-effectiveness estimates than the ones presented here.

For Zambia U-Report, the incremental costs of a scaled VMMC campaign would be much cheaper since content and programming modules are already prepared.

8. Discussion: limitations and interpretation of results

8.1 Synthesis of results and interpretation

Ultimately, quantitative impact analysis of self-reported and verified outcomes failed to detect statistically significant differences in uptake across study arms. The small sample of verified uptake was not indicative of any impact. On the other hand, self-reported outcomes – controlling for differences in consistency across reports but also subject to different interpretations – indicated non-significant but positive associations between both treatment arm conditions and higher uptake.

This intervention aimed to influence behaviour change by improving knowledge about VMMC, providing logistical information and encouraging uptake, especially by targeting barriers related to attitude, perceptions of peer beliefs and social norms and self-efficacy. However, SMS messages and counselling could not address all barriers to VMMC uptake effectively. Informing participants about VMMC service availability did not imply transportation solutions; information about the procedure's healing time could not make up for lost wages. It is possible that these barriers, which can have significant consequences on a man's life, prevented the campaigns from having a meaningful impact

on uptake, despite their apparent positive reception and high reported intention levels in the study population.

Unlike other contexts in which SMS-based communication has proven impactful, such as smoking cessation or adherence to ARV regimes (Free *et al.* 2011; Pop-Eleches *et al.* 2011), the barriers involved in taking up circumcision may not only be primarily about mind-set but can also involve more material hurdles that men interested in circumcision have to confront. Qualitative research in Zambia and Zimbabwe that aimed to map the pathways to circumcision uptake suggests that short-term consequences of VMMC – opportunity costs, threats to self-image, the implications of healing time for sex life, etc. – stall or avert uptake, especially for men in their twenties who are working or in relationships (IPSOS 2014). Among the population evaluated in this study, 75 per cent of the sample were at least 20 years old, and most survey respondents said they were in a relationship. On the other hand, since U-Report generated interest in VMMC and demand for detailed information, it may have nevertheless played a useful role in earlier stages of behaviour anticipation.

Both campaigns experienced increased levels of intention relative to the control arm, but the increase was only statistically significant (p-value < 0.01) in the tailored arm. However, uncertainty surrounds the importance of changes detected in self-reported intention to go for VMMC, where both treatment arms outperformed the control arm. If the results are truly reflective of actual intention, then interventions could realise impact on longer-term horizons if converted to action. However, social desirability bias is important to consider, and it is not unlikely that reported intention is a poor predictor of uptake. Even if participants have moved through stages of behaviour change and intention levels, barriers to uptake may still remain for participants.

A large percentage of participants reported intention to go for VMMC within two months in the baseline survey (31 per cent), yet few appeared to follow-up on their stated intention. Another study in Lusaka, Zambia identified enthusiasm for early infant male circumcision, with 97 per cent of surveyed mothers stating they would definitely or probably have their infant sons circumcised; however, only 11 per cent followed up on their stated intention (Waters *et al.* 2013). While the Waters study involved mothers making decisions for their new-borns, it still serves to highlight the gap between intention and action when it comes to circumcision.

Study results also failed to reveal clear differences between the two campaign strategies employed. While intention levels nevertheless tend to correlate with action (Armitage & Arden 2002) – as they did in this study – they may be poorly suited for 'tailored,' stage-based behaviour change messaging. That is in line with findings from the Bridle *et al.* systematic review, which found poor evidence for the relative effectiveness of stage-based strategies to influence behaviour (2007).

The U-Report VMMC interventions were, however, clearly successful in eliciting broad platform engagement broadly and around VMMC topics, in particular. Over a third of treatment arm participants engaged with U-Report in the first few days of the campaign when only three messages were delivered. Additionally, the surveys themselves elicited

higher engagement across all evaluation arms, including the control arm. Engagement levels gradually subsided, but campaign messages continued to generate questions for counsellors relating to VMMC.

Although counsellor engagement played an important role in the interventions' theory of change, there were no clear associations with uptake. This finding is notable and may suggest that addressing informational barriers or providing light-touch encouragement alone is insufficient for inducing VMMC uptake. Participants seemed to find value in counselling, so SMS components may have more potential when combined with other demand creation interventions that more directly address barriers to uptake.

Interviews and counsellor engagement data – as well as control group outcomes – showed that some participants were readily going for VMMC without the critical support of U-Report. However, important qualitative evidence also suggests that the U-Report interventions had the potential to play decisive roles in the decisions of at least *some* participants – including those with no initial intention. Most often, it appeared that the campaigns and subsequent counsellor engagement realised most value in instilling confidence and providing encouragement.

There were also signs that participants were taking advantage of counsellor resources to find out where VMMC was provided or other basic information. Many participants also reported finding value in the campaigns and said they discussed message topics with friends – even if the messages did not seem to lead directly to uptake. Interestingly, some participants revealing circumcision uptake only contacted counsellors after they went for VMMC, thus recognising the resource for information without having to leverage it to go for VMMC in the first place. This also highlights another potential role for a service like U-Report in VMMC demand generation.

Study limitations and other considerations are also important for interpreting the results, as discussed below. Importantly, the results do not preclude the possibility of smaller impact than the study was powered to detect – although cost-effectiveness estimates for the U-Report platform suggest the interventions would nevertheless be unattractive at smaller levels of impact. The study's results are also specific to the specific interventions – their strategies, their counsellor support and their message content – and other campaigns on U-Report or elsewhere could have different impacts.

8.2 Internal validity

8.2.1 Attrition

Non-response to SMS surveys was an expected feature of the study.[29] Although 2,312 U-Reporters were enrolled in the study after baseline, 302 participants did not respond to any follow-up survey and were not included in the evaluation analysis. Based only on

[29] 'Response' is defined as valid response to survey questions on VMMC uptake (3rd or 4th question into SMS surveys). Therefore, some participants responded to surveys but may not have *completed* them fully (e.g. intention reports or uptake details may be missing for some who reported their status).

available age, district, tribe and intention data, these lost participants were not statistically different across arms nor were they statistically different from those who did respond to at least one survey.

Table 28 shows declining response rates to successive surveys over the course of the study. While some data exist for 87 per cent of the original sample, only 67 per cent of the original sample (78 per cent of the final sample used in analysis) responded to the last survey. Therefore, outcomes only partially measure and compare uptake six months after campaign initiation.

Table 28: SMS survey response yields

SMS survey	Respondents (of original sample)	Response rate	Control arm	Conventional arm	Tailored arm
Two-month survey	1,737	75%	75%	77%	74%
Four-month survey	1,661	72%	74%	72%	70%
Six-month survey	1,553	67%	67%	69%	64%
Any survey	2,010	87%	87%	88%	86%

Declining response rates over time are in line with declining counsellor engagement over time. The drop in participants' attention suggests that messages sent early on in a campaign have higher potential for impact. Notably, though, the even decline in survey participation across all arms also suggests that the campaign messages did not have any effect on participants 'tuning out' incoming messages from U-Report.

As displayed in table 29, only 53 per cent of the original sample (61 per cent of the final sample used in analysis) responded to all three follow-up surveys, leaving data gaps for a large proportion of participants.

Table 29: Depth of survey response

Participants responding to…	# of enrolled sample	% of enrolled sample	Control arm	Conventional arm	Tailored arm
No surveys	302	13%	13%	12%	14%
One survey	280	12%	11%	12%	13%
Two surveys	514	22%	23%	22%	22%
Three surveys	1,216	53%	53%	54%	51%
Total	2,312	100%	100%	100%	100%

8.2.2 Undetected ineligibility

U-Reporters were initially screened by registered sex, age, and study area to participate in the baseline screening survey, which further eliminated potential participants from the

sample frame by reported circumcision status. However, some participants later revealed or suggested that they would have been ineligible. Actual ineligibility could not be determined for all participants, and most determinations had to be based on self-reported data.

Most importantly – despite all participants reporting that they were uncircumcised at baseline – a significant number of participants appear to have been circumcised prior to that survey. In the two-month follow-up survey, an unrealistically large number of participants – 441, or 24 per cent, of survey respondents – said they were circumcised, implying either that responses to the new survey were false or that many participants had already been circumcised at baseline.

Some participants also reported uptake in the period between the baseline survey and the VMMC campaign's initiation (when randomisation and campaign set-up was taking place). As nobody had yet been exposed to the interventions, these participants were also dropped from the analysis if their reports met outcome criteria. Table 30 highlights the high percentage of uptake reports before the study by various outcome criteria, including 36 per cent of verified reports.

Table 30: Uptake prior to campaign according to outcome criteria

Criteria	# of uptake outcomes before campaign[30]	% of uptake outcomes (by criteria)	% of original study sample (N=2,312)
Any report of uptake (model 1)	430	54%	(22%)
Only reports that are non-contradictory (model 4)	200	51%	(10%)
Only reports that are fully consistent (model 7)	136	74%	(7%)
Verified reports with client data	13	36%	(<1%)

Finally, some participants revealed that they were staying outside the study area or that they may have been less than 15 or older than 30 years old. Although these participants were not intended to be included in the study sample, they were not dropped from the analysis since campaigns were aimed at participants as they were registered and since their outcomes were still of interest. The presence of participants outside the study area affected the study's ability to independently verify reported uptake.[31]

8.2.3 Self-reported data and possible bias

Self-reported data has serious potential for unreliability and bias, and most criteria were expected to overestimate true uptake. Additionally, evidence suggests that circumcision is highly misreported for various reasons – even when circumcision is defined and the

[30] For self-reported data: more than 1/3 of uptake report dates prior to 8 May; for verified data: matching client uptake before 8 May 2014.

[31] Of participants reporting where they went for VMMC uptake, 112 of 772 (14.5 per cent) said they were circumcised outside of Lusaka and Chongwe.

reports are subject to clinical verification. A 2012 study by Hewett et al found that of the men surveyed in urban Lusaka who said they were circumcised and agreed to a clinical examination, about 30 per cent were actually uncircumcised (Hewett *et al.* 2012). We were unable to clinically verify reported circumcision status. In our study, participants were not only asked if they were circumcised but also about when and where they actively 'went' for the procedure. Since they were not required to undergo a clinical examination, it is possible that a higher percentage of participants in our study felt more at ease to provide misinformation. Indeed, a very high proportion (57 per cent) of baseline survey respondents said they were already circumcised, compared to the 23 per cent of participants surveyed in the Hewett study (Hewett *et al.* 2012). On the other hand, because this study was done among U-Reporters, youth who are assumed to be more health-conscious, it is likely that a higher proportion of this population actually was circumcised compared to the general population in the Hewett study, though likely not at the level reported. Additionally, interviews and inferences about the sample in this study suggest that participants are more aware of VMMC relative to the general population. Therefore, misinformation – if it explains the misreporting found by Hewett – may be less of a problem for this study.

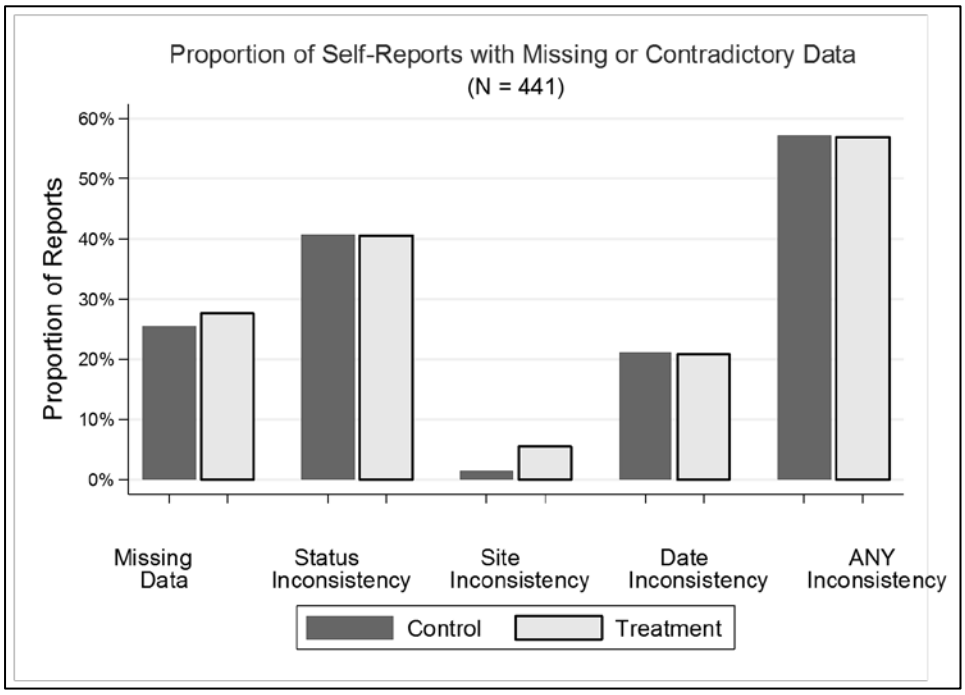
Any bias affecting study arms uniformly would likely be controlled for through randomisation, so a critical question for interpreting potential impact is whether the treatment conditions induced added social desirability bias. Another possibility is that bias could be introduced if treatment-arm participants better understood circumcision and misreported uptake less as a result. Three tests failed to reveal evidence of either statistically significant bias or possible bias in a uniform direction:

1. A lower proportion of self-reported uptake (using self-reported criteria #4) was verified for treatment arm participants (5.2 per cent) versus control arm participants (6.0 per cent), but not by a statistically significant margin (p-value=0.728).

2. Bias could be reflected if treatment group participants more frequently reported uptake circumcision date *prior* to the start of the campaign compared to participants in the control group. In other words, if someone were to say they were circumcised when they were not, the date of the procedure that they give is likely to be somewhat random and arbitrarily could be before or after the campaign start date. However, of all participants reporting uptake dates, the proportion of control arm participants reporting pre-campaign uptake was 5.5 percentage points higher than the proportion of treatment arm participants (not statistically significant; p-value=0.436). This test only checks for across-the-board bias, and desirability bias could manifest itself in participants more likely to falsely report recent uptake.

3. Treatment group reports were only slightly more inconsistent and included more missing data (figure 14). The differences – either alone or in aggregate – were not statistically significant. These factors were also controlled for through restrictive outcome criteria. Although it is certainly possible for participants to falsely report uptake on a perfectly consistent basis, it is probably less likely.

Figure 14: Missing and contradictory report data in control and treatment arms



Although social desirability bias specific to the treatment arms was not detected or strongly suggested by the data, it could certainly exist, and even small margins of treatment-arm bias would have important implications for interpreting self-reported outcomes.

8.2.4 Survey contamination

Surveys sent to all study participants inevitably prompted control group participants to think about VMMC and engage counsellors on the topic. Figure 10 (see section 7.6) illustrates contamination by showing spikes in U-Report engagement by control group participants around surveys. The baseline survey in particular stimulated sustained higher-than-usual engagement levels among all survey participants prior to the VMMC campaign's launch. In total, 377 (49 per cent) of control group participants engaged U-Report between the baseline survey and the endline survey. Of those participants, 68 per cent messaged U-Report within the two-day periods after SMS surveys. Ultimately, however, messages to U-Report following SMS surveys was not linked to uptake outcomes within the control arm.

In designing the study, survey effects were assumed to be minimal and outweighed by the evaluation benefits of multiple points of potential follow-up. Anecdotally, however, one control-group interviewee did state explicitly that the baseline survey prompted him to go for VMMC. Only twenty-four reports of uptake were verified during the study period, but an additional 10 were verified during the three weeks between the baseline survey and the campaign's delayed launch. This was a national VMMC campaign period, but some of those original study participants could have been spurred to go by the baseline survey alone.

Hawthorne effects – in which study participants could be more likely to go for VMMC in the study period if they perceived they were being evaluated – cannot be ruled out. Survey questions about intention could also force some participants to formalise and articulate decisions regarding going for VMMC, resulting in a higher likelihood to act. Along the same lines, asking participants about their intention levels could influence their responses in later surveys. In order to appear consistent, one participant said in an interview that he falsely reported uptake in a survey after failing to achieve his stated intention of going for VMMC within two months. All of these possible effects, if present, would most likely be controlled for since all participants received SMS surveys, but they would also reinforce the unreliability of self-reported uptake.

8.2.5 Other sources of spillover, contamination and non-unique participants

The U-Report VMMC interventions spurred broader engagement with U-Report on topics other than VMMC (e.g. sexual health; information on STIs). Activity generated on the platform is worth considering as an avenue for positive externalities, especially since U-Report is designed to be a multi-purpose platform.

Positive spillover in the form of leaked messages to non-study participants is difficult to detect, but a majority of interviewees, when asked directly, said they sometimes discussed messages with friends or family. Contaminating interaction between unique treatment group and control group participants could also be a source of bias, especially if groups of friends are enrolled on the platform. While spillover effects cannot be ruled out, there was no statistically significant or indicated association between campaign message delivery to the treatment groups and incoming messages from the control group, a simple proxy for exposure to VMMC messages.

Finally, potential problems were posed by the possibility that study outcomes were associated with unique phone numbers but not unique individuals. First, multiple people could be associated with a shared phone – either receiving messages or responding to surveys (table 31). This could have accounted for some of the inconsistencies in responses. Second, it is highly likely that some participants were enrolled on U-Report with multiple phone numbers. We detected six of those participants, because the last five phone numbers and demographic information were the same. Participants with multiple phone numbers that do not share the last five digits, however, would not have been detected.

Table 31: Reported phone usage

	Sample data (N=1,652)	
	No.	%
Do other people regularly use this phone as well?		
No	1,255	76%
Yes	389	24%
Unknown	8	0%

Which phone number do you use the most?		
No	921	56%
Yes	729	44%
Unknown	2	0%
Primary Phone Number		
Registered Number*	1,375	83%
Another Number	72	4%
Multiple Numbers Equally	164	10%
Unknown	41	2%

Note: * Participant either has one phone number only or others are not primarily used

8.3 External validity: study context

This evaluation had the narrow aim of measuring the impact of two specific behaviour change campaigns – run on a specific platform with a subset of particular participants – on VMMC uptake in a six-month window. The control group had routine access to U-Report, so the control group was not entirely 'untouched'. Additionally, the evaluation was only among U-Report subscribers; it did not attempt to compare U-Report subscribers to non-subscribers.

Furthermore, the SMS campaigns did not occur in isolation of other VMMC promotion in the study area, including television and radio ads, billboards and print advertisement, and community mobilisation activities by districts and health facilities. The study period overlapped with a national VMMC 'campaign month', when there was particularly high publicity.

Several factors are worth considering when generalising the study's findings to the wider population of U-Reporters in Zambia:

- Participants who responded that they were already circumcised in the baseline survey were excluded from the study. However, the high proportion of respondents (57 per cent) is probably unrealistic, and many may have later responded they were uncircumcised. Some of these participants – who may be ready to go for VMMC – could be affected by campaigns differently if included.

- Participants enrolled in the study (who responded to the baseline survey) – and those who continued to respond to surveys – may have been more likely to engage U-Report and be receptive to a campaign.

- U-Reporters registered in the study area could be different in relevant ways from U-Reporters in other parts of Zambia.

- The particularities of the U-Report platform are also very important to consider when thinking about the potential of SMS interventions to generate demand for VMMC on other platforms, whether in the Lusaka area, in Zambia, or in the region:

- U-Reporters may care more about sexual health, given that they subscribed on their own to a platform designed to provide information related to HIV/AIDS and STIs.

- U-Reporters could also be disproportionately HIV-positive, possibly affecting perceptions of VMMC and responsiveness to campaign messages about HIV protection.[32]

- U-Reporters may already be aware of VMMC and its benefits, and they may have made up their mind to go for the procedure or not, to a greater degree than non-participants.

- U-Reporters are also different from other groups demographically, including in terms of age. Inferences about the sample frame and survey responses indicate that participants are relatively highly educated, with a third of respondents having started or completed post-secondary education, for example.

8.4 Evaluation and campaign weaknesses

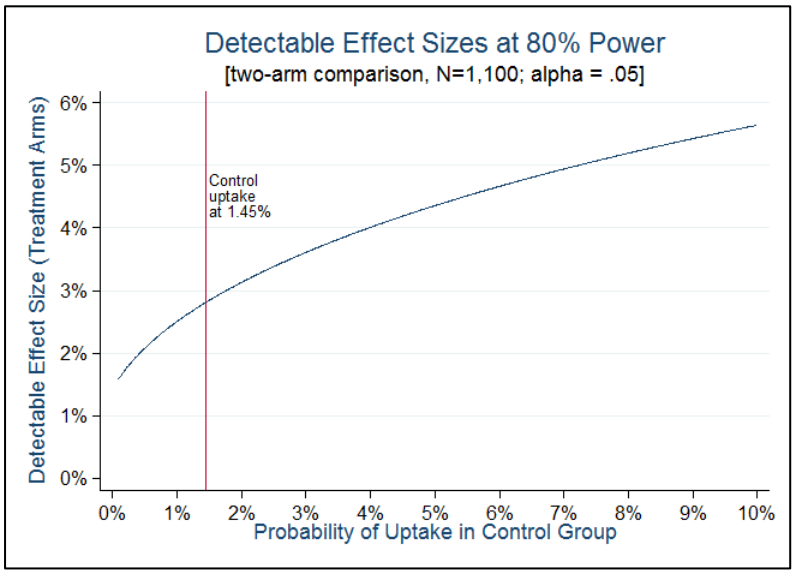
8.4.1 Statistical power

Based on the final study sample, figure 15 retrospectively shows the study's power to detect statistically significant differences in uptake. Before accounting for covariates that help to predict uptake, the study was only powered to detect differences in uptake across study arms of almost 3 percentage points, given a reasonable minimum probability of uptake for the control group of 1.5 per cent based on verified data. This power is similar to the less optimistic-case power calculation scenario presented in appendix D used to set a target sample size of 2,550 before attrition (not obtained). However, considering the potential of SMS interventions to scale at low cost, even smaller effect sizes could be noteworthy and of interest to policymakers in other settings.

Due to sample size limitations, the evaluation was also not powered to detect possible differences in effectiveness between the conventional and tailored intervention arms, which both sourced messages from the same bank of content. In terms of operational lessons, the tailored campaign proved feasible but also required higher design costs (particularly in time/effort) and required the structured SMS surveys that happened to be folded into the evaluation for full implementation. In the absence of clear or indicative impact particular to the tailored campaign, further analysis of messages sent to those with high intention levels could be used to inform a mix of messages in any revised/ improved campaign on U-Report or another platform. Additionally, such a high proportion of baseline participants reported intention to go for VMMC that aspects of the tailored campaign could more justifiably be merged into another conventional-style campaign.

[32] Although VMMC is much less relevant to HIV-positive men – for whom the public health externalities are also absent – the Government of Zambia does not discriminate in offering free VMMC services.

Figure 15: Detectable effect sizes for different control group uptake levels



8.4.2 Survey weaknesses

Self-reported data were weaker than they otherwise could be due to the SMS medium demanding short, simple questions and short surveys. Besides limiting the evaluation's ability to collect additional information, such as knowledge about VMMC, the surveys also had limited potential to collect nuanced or detailed information. Additionally, the ease of answering the surveys could have contributed to the unreliability of data.

As noted, the English proficiency of U-Reporters in the sample is estimated to be high. However, even though all participants responding to surveys responded in English, some participants may have struggled. Poor proficiency or interpretation of the simple questions could have contributed to weaker data on the margins. Finally, participants who were not English proficient may not have responded to the surveys at all, introducing potential bias.

8.4.3 Verification challenges

Anonymous study participation posed challenges for verifying circumcision statuses, and simple SMS surveys were the only avenue to gain outcome data on uptake for analysis purposes. In other settings, follow-up schemes in person or over the phone could have overcome some of the limitations associated with client-based verification.

Additionally, the evaluation only attempted to verify reported circumcisions; it was impossible to verify the circumcision status of those who said they were uncircumcised. It is possible, therefore, that some circumcised men were included in the study sample. It is also possible that some circumcision uptake may have gone undetected, though clinical survey evidence from Lusaka suggests that misreporting of status by those who are truly circumcised is very rare (Hewett *et al.* 2012).

8.4.4 Campaign weaknesses

As discussed in the process evaluation, a relatively minor campaign lapse between months two and four of the study period led 97 participants in the tailored arm to miss seven SMS campaign messages. Therefore, the point estimate for the tailored arm's uptake could slightly underestimate potential uptake, if there were positive impact.

Additionally, there was no way to verify that messages that were sent were actually received. Issues with network connectivity, disconnected phone numbers, or other technical problems could have resulted in low response rates or low response to campaigns. These were issues largely out of the implementers' control, and potential scale-up scenarios would probably experience similar challenges. These issues, however, could have resulted in an underestimate of impact if the campaign messages were not actually reaching U-Reporters.

Many interviewees complained about slow counsellor response time, and some said counsellor responses were too general. Deficiencies in these areas could have disrupted potential and demand for more interactive and in-depth counselling, possibly preventing the campaign from meeting its potential impact.

9. Conclusions

This evaluation measured potential impact of two SMS-based campaign strategies on the uptake of VMMC. Findings suggest that neither campaign strategy was effective at generating demand. The campaigns were, however, effective at increasing engagement with SMS counsellors on the U-Report platform, enabling U-Reporters to access answers to their specific questions about VMMC or to receive individualised support. Qualitative data also suggested that SMS-based interventions could play a more nuanced or indirect role in influencing a man's decision to get circumcised. Thus, while SMS-based campaigns on U-Report are unlikely to be effective stand-alone interventions for VMMC demand creation, they may still have a role to play in decision-making processes.

10. Actionable findings for policy, implementation and research

The evaluation results provide numerous takeaways for policymakers, programme implementers and researchers.

10.1 Policy recommendations

Because of the study's null results, we do not recommend that the U-Report platform be used to scale-up either of the campaigns evaluated. Nevertheless, U-Report's administrators as well as other parties may still be interested in continuing to explore SMS-based tools for VMMC demand generation.

10.1.1 Low-cost implementation of SMS campaigns promoting VMMC should be prioritised

The five-month campaigns evaluated did not have detectable effects on VMMC uptake, and if SMS campaigns nevertheless have potential to move participants to uptake, any impact would probably be small. SMS-based communication importantly has potential to reach participants at low cost, and that advantage would need to be leveraged in order to make low-impact interventions cost-effective.

U-Report benefited from an existing base of platform enrolees, and the marginal costs of the campaign would have been very high if participants were recruited for VMMC demand generation, alone, or if the platform was set up specifically for this purpose. Any SMS campaigns should take advantage of existing infrastructure and pools of relevant participants.

Campaign tailoring requiring added programming time and participant surveying do not appear worthwhile.

10.1.2 There appears to be value in simple prompting

Overall, interviews and messages to counsellors suggested that participants were aware of VMMC and already had basic information. SMS messages seemed most important for reminding participants about counsellors and prompting participants to think about VMMC. The baseline survey asking simple questions about circumcision without providing any information yielded high counsellor engagement by itself. This, coupled with waning engagement over time, suggests that simple questions or prompts may be just as effective as longer, more elaborate campaigns at increasing demand for information in the context of a counsellor-supported platform.

10.1.3 SMS tools may have more potential when linked with counselling services and other interventions

The value of the SMS campaigns appeared to be largely mediated through counsellor interactions. Indeed, campaigns spurred high levels of counsellor engagement, though that engagement and demand for information was not translated into VMMC uptake. Providing encouragement and information may still be important, but either more intensive engagements or activities addressing other barriers to uptake may be necessary in conjunction with SMS-based communication.

SMS-tools provide easy routes to low-cost follow-up. Participants engaged more intensively through alternative interventions could continue to be prompted and encouraged to go for VMMC through SMS messages.

10.1.4 Policymakers should consider potential value in structured, SMS-based post-operative engagement

Many participants engaged U-Report only after they went for circumcision and revealed demand for post-operative information and counselling. Policymakers may find value in

this tangential service, especially if it can be provided alongside or separately from demand creation.

10.1.5 Evaluation components should be built into future piloting and scaled implementation

Uncertainty remains about the potential of SMS-based VMMC demand creation, especially in other settings or with different strategies. Wherever possible, implementation should be combined with further impact as well as process and/or qualitative evaluation.

Recommendations for future research are provided below.

10.2 Operational lessons

Several lessons from campaign and research implementation could be useful for others:

- **Staggered rollout of campaigns and surveys could alleviate pressure on server and counsellor capacity**. Although the study was implemented without major problems, the large baseline survey began to run up against system capacities. Simple measures would circumvent this challenge.
- **Airtime incentives can boost response rates for SMS research surveys**. Fears around negative effects on future engagement have not been realised at notable levels, but effects of incentives can continue to be monitored.
- **Verifiability was essential to the study's design**. Self-reported data was even more unreliable than expected and would be hard to interpret without some degree of verifiability.
- **Recruitment efforts should be directed where they have greatest returns.** The potential of SMS-based behaviour change rests in part on low-cost scalability, and recruitment is a major fixed cost. From this project's experience, rural recruitment may only be cost-effective if efforts leverage large gatherings of youth (e.g. community events).
- **VMMC referral should be focused on facilities providing the most reliable services**. Many sites in the study area provided variable services over the course of the evaluation. For urban areas with many sites offering VMMC, referral can be prioritised to sites that provide consistent services on a weekly basis over time. Counsellors can still provide information on other sites as requested.

10.3 Recommendations for future research

This evaluation provided the first narrow examination of a focused, sustained campaign on Zambia U-Report. As U-Report policymakers consider the platform's broader value and cost-effectiveness, this research should serve as a starting point. Future research should look at the platform's impact in other service areas and produce evidence that can be used to constantly improve its offerings.

10.3.1 Questions for future research

For policymakers still interested in the potential of SMS-based demand generation for VMMC, this evaluation leaves many questions for future research. Two unanswered questions stand out in particular, which could help guide similar, follow-on evaluations:

- Can an *improved* campaign – either on U-Report or another platform – achieve larger, statistically significant impact?
- How would similar interventions fare in other settings or alongside other interventions?

Smaller research questions could also be addressed through further process evaluation and qualitative research in order to improve SMS-based VMMC campaigns:

- What campaign length and level of intensity is optimal?
- What role does (or can) counselling play in decision-making and uptake? How important is the expensive intervention component to SMS interventions?
- How can SMS-based demand generation be integrated with other services or link participants to further resources?
- Which types of messages appeared to be best at engaging users?

10.3.2 Implementing future research

SMS-surveys provided a necessary starting point for understanding the campaigns' impact and for follow-up, but data from individual surveys proved very unreliable. Multiple surveys with the same questions provided a means to judge the reliability of individual participants' answers. However, as noted, self-reported SMS survey data alone would be very weak without some degree of external verification.

The study's limited phone interviews proved extremely useful, both for obtaining qualitative insights and for better understanding realities behind self-reported uptake and intention in surveys. Detailed questions about interviewees' circumcision uptake (e.g. process involved in being circumcisions) yielded reliable circumcision status data. The simple semi-structured interviews designed for counsellors to implement also yielded important insights. If it were not for constraints imposed by participants' confidentiality and the interview procedures, phone (or in-person) interviews could have been even more valuable. Additionally, if self-selection bias could be avoided in other research contexts, interviews could help substitute for more intensive facility-based uptake verification.

Appendix A: Intervention messages

Message set #1 (May–June)

	Conventional Arm Message Set #1	Pre-Cont' Set #1	Tailored Arm Contemplation Set #1	Preparation Set #1
7-May	Hi! Male Circumcision removes the foreskin to which HIV virus cn easily attach. This reduces chances of getting infected by 60prcnt. Text ur counselor 4 more	Hello U-Reporter! Did u know that Male Circumcision(MC) provides partial protection from HIV and other STIs? Text your counselor for more!	Hi U-Reporter! MC helps protect u from more than HIV--Syphilis, HPV, Penil cancer, e.t.c..Any Questions?	Hello! MC is both quick and very safe. Do you have any concerns before you go? Whatever your questions, your counselor has answers! SMS them now!
9-May	Hello, U-Reporter! Over 800, 000 Zambian men have already gone for MC! Ready 2 join the ranks? Ask your counsellor for information.	Hi! Male Circumcision removes the foreskin to which HIV virus cn easily attach. This reduces chances of getting infected by 60prcnt. Text ur counselor 4 more	Hello! MC benefits both partners, n u shud talk to ur partner n make a decision 2gether. Protect each other frm STIs like HPV in women and HIV, up to 60prcnt!	Hello, U-Reporter! If ur ready 2 join the ranks of over 175,000 circumcised Zambian men, then pick a date to go. Make ur plans! Ask ur counsellor for help!
11-May	Hi U-Reporter! MC helps protect u from more than HIV--Syphilis, HPV, Penil cancer, e.t.c..Any Questions?	Hello! Surveys in Zambia found that most women who know about MC prefer circumcised men. Top reason is disease prevention, 2nd reason is sexual satisfaction.	Hello! Men who go for MC feel great about themselves. It's a real accomplishment--and one that has great benefits for you too! Ask ur counsellor how to get MC!	Hello! Free, quality MC Services are accessible in ur area, n u have many choices. Ask ur counsellor about MC facilities with trained n experienced providers!
26-May	Hello! MC does NOT negatively affect sexual performance. In fact, many men say it makes them better! Text ur counselor now 2 find out health benefits of MC!	Hi Ureporter! Did u kno foreskin is easily damaged durin sex, exposing u to high STI infection rates? MC can giv u 60prcnt HIV protection. Ask ur questions now!	Hey U-Reporter! Do u have any concerns about going 4 MC? Afraid of pain? Want to kno about healing? Availability? Text ur counselor now with ur questions!	Hi U-Reporter! Did u kno that pain is controlled durin n afta MC? Follow provider instructions durin the healin, n then u'll be a new man! Ask ur question now!
2-Jun	Hi Ureporter! Quality MC is available in ur area free of charge, n u have many choices. Ask ur counsellor about MC clinics with trained n experienced providers!	Hello! Male circumcision (MC) reduces the risk of men infectin their partners wit the HPV virus that causes cervical n penile cancers. Text ur counselor 4 more!	Hello! Quality medical male circumcision is provided free of charge at many government clinics. SMS ur counselor now 2 see if ur preferred clinics offer MC.	Ureporter, u probably hav friends who went 4 MC. If ur ready to go, ask them about their experience! Ur counselor can also answer questions confidentially.
8-Jun	Hey U-Reporter! Do u have any concerns about going 4 MC? Afraid of pain? Want to kno about healing? Availability? Text ur counselor now with ur questions!	U-Reporter, r u concerned about eligibility for MC? If so, text ur counsellor now! When u go to clinic 4 MC, u will talk 2 medical providers n counselors first.	Hi U-Reporter! Circumcision eliminates bacteria build-up under ur foreskin. It keeps u clean! Text ur counselor now to find out more benefits of MC!	Ureporter, if ur not sure where to go for MC, ur counsellor can help. There is no cost 4 MC! Text now 2 find MC sites near u, or ask about ur preferred clinic!
16-Jun	Hi U-Reporter! Circumcision eliminates bacteria build-up under ur foreskin. It's good for your hygiene! Text ur counselor now to find out more benefits of MC!	Hello! MC does NOT negatively affect sexual performance. In fact, many men say it makes them better! Text ur counselor now 2 find out health benefits of MC!	Hi! Real men protect their woman. If you luv her, get MC 2 reduce chance of gettin n passin on z virus causing cervical n penile cancer. Text 4 mor info on HPV.	U-Reporters can lead the fight against STIs, HIV and cervical cancer! Get MC today 2 play ur part, benefiting u and ur partner. Text 4 info on ALL the benefits!

Message set #2 (July–August)

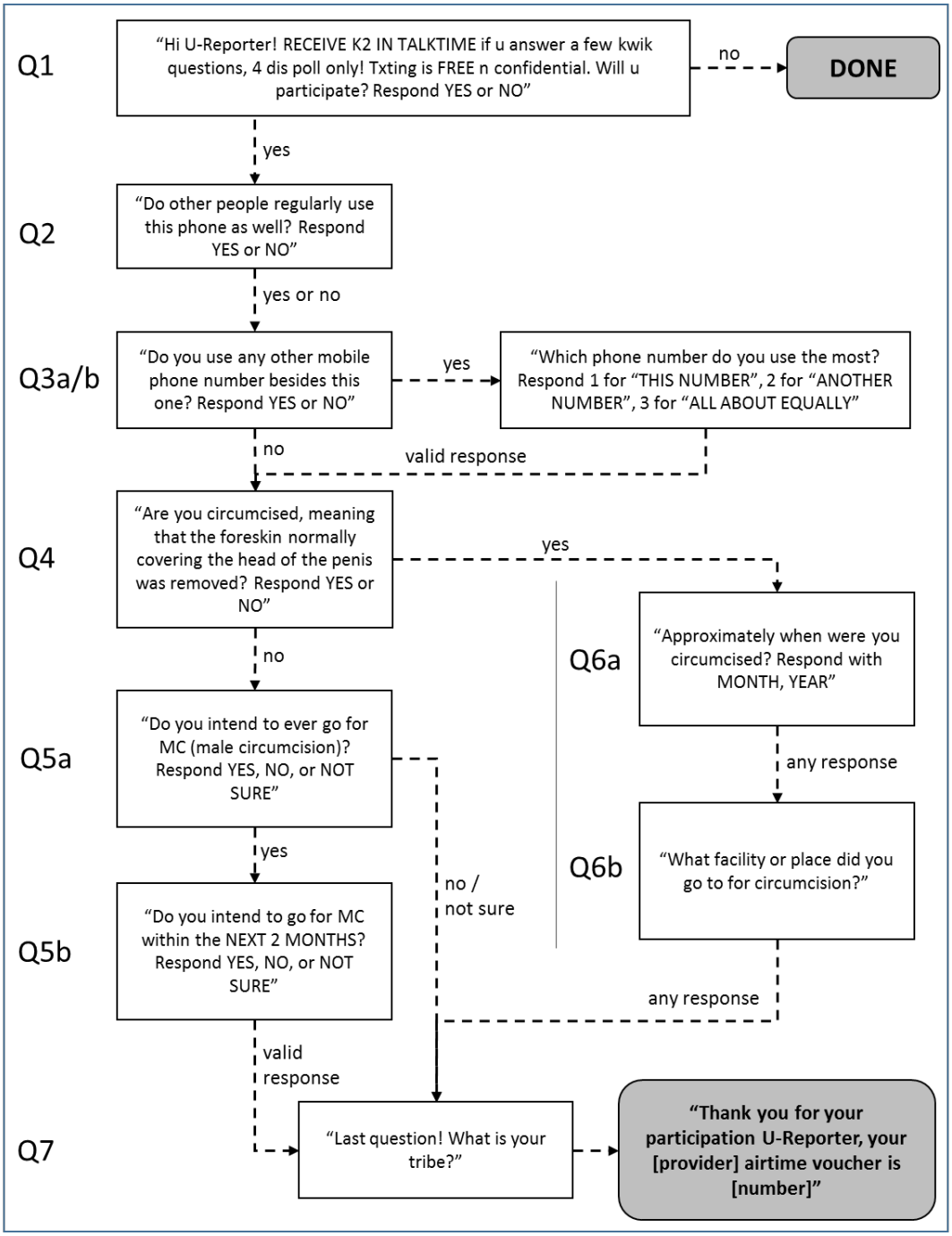
	Conventional Arm		Tailored Arm	
	Message Set #1	**Pre-Cont' Set #1**	**Contemplation Set #1**	**Preparation Set #1**
10-Jul	Hello! Surveys in Zambia found that most women who know about MC prefer circumcised men. Top reason is disease prevention, 2nd reason is sexual satisfaction.	Hey U-Reporter! Know the benefits of MC! Besides partially protecting you from STIs like HIV and syphilis, its also good 4 your hygiene--it keeps u CLEAN.	Ureporter, did you know! Only trained staff conduct medical MC at clinics. Its a SAFE procedure n u fully heal in 6 wks. Pain is gone in few dayz, n u get meds	Hello! Discuss ur desire to go 4 MC with ur partner, friends or family. Its always good to talk, n ur Ureport counselor is also here 2 help u take next step!
15-Jul	Hi! MC is conducted by trained medical staff n it is very safe. Ur provider will giv u medicine 2 reduce pain durin n afta procedure. Ask now about MC clinics!	Hello! Medical MC is a safe procedure 4 everyone in which SKILLED providers remov th foreskin. It givs u added advantage from STIs! Ask for more info now!	Hi Ureporter! Have u talked to you partner about MC? You should! MC isnt only for single men. Ask your counsellor if you want tips or encouragement.	Ready 2 go 4 MC, Ureporter? Kno WHERE 2 go? And WHEN u'll go? Once u decide, SMS ur counselor about what to do afta the procedure, or bout what u should expect
18-Jul	Hi U-Reporter! Over 750,000 Zambian men have already gone 4 MC. Ask ur counselor about joining the team of Men Who Care!	Hi U-Reporter! Over 750,000 Zambian men have already gone 4 MC. Ask ur counselor about joining the team of Men Who Care!	Hi! Need another reason 2 go 4 MC? Surveys in Zambia show that women who kno about MC prefer circumcised partners. Choose a date n ask ur counselor where to go!	Hi U-Repoter! Some men like 2 go 4 MC with their friends. Get a group 2gether n choose a date 2 go. Ask ur counselor about MC clinics near u!
27-Jul	Hello! The pain u get after MC lasts few days, but the benefits last 4ever. MC reduces ur chance of getting STIs like HIV and HPV virus that causes cancers	3 young Zambians get infected every hour wit HIV. NOT COOL! Step up th gear n lead z fight against HIV with MC. SMS ur Ureport counselor n then choose a clinic!	Hello! The pain u get after MC lasts few days, but the benefits last 4ever. MC reduces ur chance of getting STIs like HIV and HPV virus that causes cancers	Hi! Sum men r scared of HIV tests at MC. Testing is always good and we encourage but its NOT mandatory. Talk 2 ur provider 1st. SMS now if u hav otha questions!
1-Aug	Ready 2 go 4 MC, Ureporter? Kno WHERE 2 go? And WHEN u'll go? Once u decide, SMS ur counselor about what to do afta the procedure, or bout what u should expect	With so many men going 4 MC, u probably hav friends who hav gone. U should talk to them 2 hear their thoughts! And if u hav any questions, ask ur counselor now!	Ureporter, if one-week old babies can get MC, then you can do it too! Be a man and go for MC! Text ur counselor now 4 more info!	Hi! MC is conducted by trained medical staff n it is very safe. Ur provider will giv u medicine 2 reduce pain durin n afta procedure. Ask now about MC clinics!
3-Aug	Hello! MC doesnt make u a 'lesser man'. Quite the opposite! It shows u r responsible for urself n also ur partner. FIGHT STIs n cervical cancer! Step up!	Hello! MC doesnt make u a 'lesser man'. Quite the opposite! It shows u r responsible for urself n also ur partner. FIGHT STIs n cervical cancer! Step up!	Be a Man! Join the thousands of Zambian men and Ureporters who have already gone for MC. Text ur counselor to find out how to get MC, n then choose a date 2 go!	Hello, MC is a quik procedure and u will be back to work within 3 days Some men r ready next day. SMS ur counselor now or talk 2 a provider to find out more!
16-Aug	Hi Ureporter! Have u talked to you partner about MC? You should! MC isnt only for single men. Ask your counsellor if you want tips or encouragement.	Hi! Some men avoid MC cuz dey r afraid of pain. Actually, its manageable with meds, n the benefits easily outweigh a day or 2 of pain. Ask if u hav questions!	Hi U-Reporter! Many of ur friends hav probably gone 4 MC. Talk to them today to get their input, or text now for info on gettin MC urself!	Ureporter, if ur not sure where to go for MC, ur counsellor can help. There is no cost 4 MC! Text now 2 find MC sites near u, or ask about ur preferred clinic!

Message set #3 (September–October)

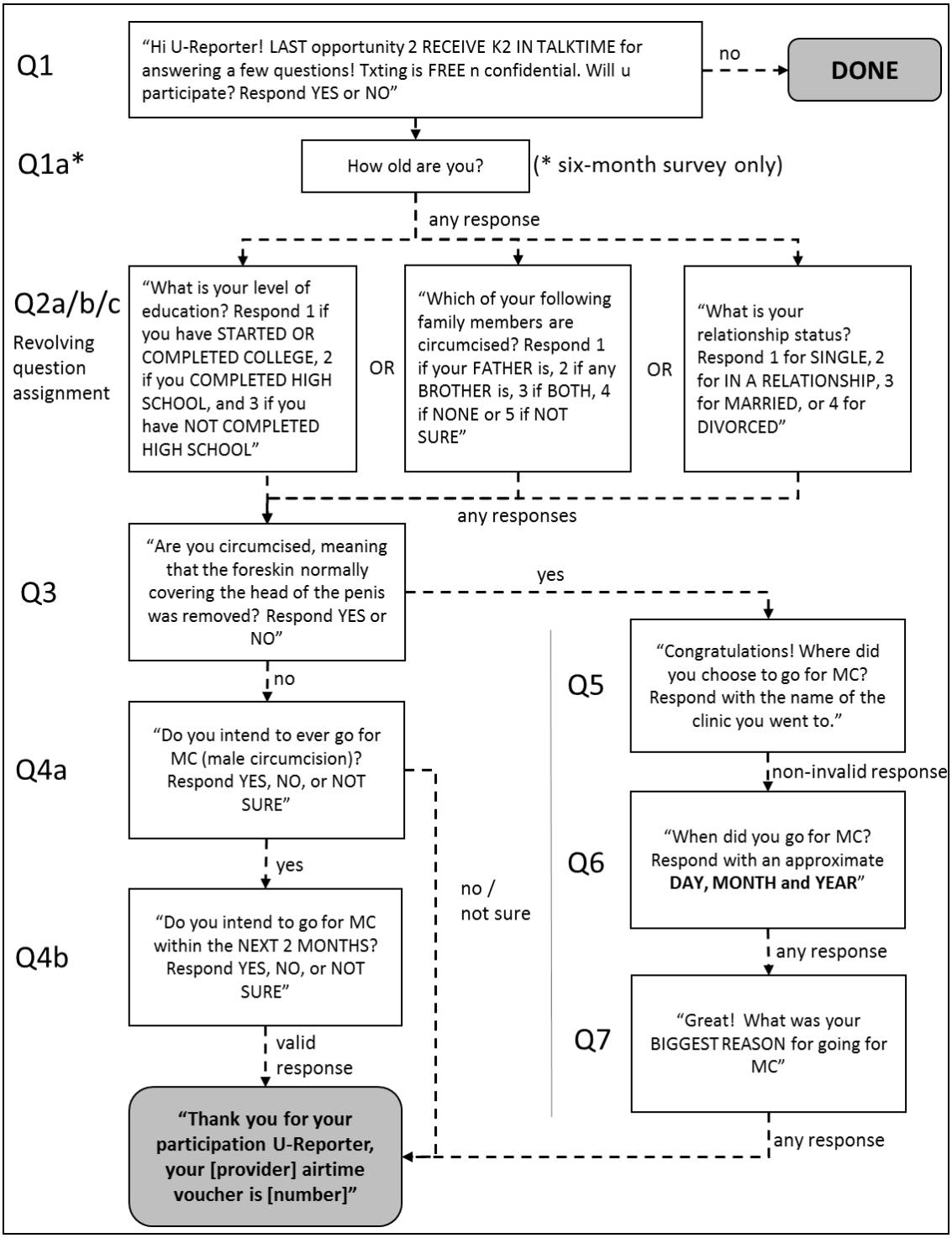
	Conventional Arm		Tailored Arm	
	Message Set #1	**Pre-Cont' Set #1**	**Contemplation Set #1**	**Preparation Set #1**
10-Sep	Hi! So far, over 150,000 Zambian men have gone 4 MC in 2014, n OVER HALF of U-Reporters said they r circumcised. What r YOU waitin 4? Text 4 mor info on MC	Hi! So far, over 150,000 Zambian men have gone 4 MC in 2014, n OVER HALF of U-Reporters said they r circumcised. What r YOU waitin 4? Text 4 mor info on MC	Hi! Ther r many reasons men r goin 4 MC, like disease prevention or partner preference. So wats holding YOU back? Ur counselor is ready 2 answer ur questions!	Ready 4 MC, U-Reporter? The sooner u go, the sooner you will enjoy the benefits. Over 150,000 men have already gone 4 MC in 2014… y dont u be da next guy?
12-Sep	Hey there! Da foreskin allows HIV into ur body, n tiny tears on d skin r also common durin sex. Reduce ur chance of gettin HIV n other STIs by goin 4 MC) 2day!	Hi! Did u kno MC goes back 2 biblical times n is practiced in cultures and religious traditions? Today, its popular 4 health benefits like hygiene.	Hi U-Reporter! Fear of pain holding u back from MC? Actually, its not so bad with meds n proper care. Ask ur counselor where to go for safe MC clinics near you.	Hi U-Reporter! Meds and proper will make MC ez 4 u. Ask ur counselor where to go for safe MC clinics near you, open weekdays and weekends too.
14-Sep	Added protection from STIs, better hygiene, personal pride… its all just round the corner. All u need to do is pick a date for MC! Ur counselor can help!	Hey there! Da foreskin allows HIV into ur body, n tiny tears on d skin r also common durin sex. Reduce ur chance of gettin HIV n other STIs by goin 4 MC) 2day!	Wat r u waitin 4, U-Reporter? MC is an EZ procedure available ALL year at MANY clinics, 4 FREE! Pick a day when u hav a few days 2 heal. SMS ur counselor 4 help	Ready 2 go for MC? Once you choose a date, prepare questions 4 ur provider. In the morning, eat a healthy breakfast, take a bath and wear a loose pair of pants
25-Sep	Wat r u waitin 4, U-Reporter? MC is an EZ procedure available ALL year at MANY clinics, 4 FREE! Pick a day when u hav a few days 2 heal. SMS ur counselor 4 help	Hi! Did u kno that MC provides protection from mor than jus HIV? 4 example da STI that causes penile cancer in men n cervical cancer in women. Text 4 otha STIs	Imagine ur life after MC.. a future with added protection from STIs plus otha benefits.. Now make it happen by joining the team of proud circumcised men	Added protection from STIs, better hygiene, personal pride… its all just round the corner. All u need to do is pick a date for MC! Ur counselor can help!
30-Sep	Hi! Ther r many reasons men r goin 4 MC, like disease prevention or partner preference. So wats holding YOU back? Ur counselor is ready 2 answer ur questions!	Reduce ur stress, U-Reporter! MC PROTECTS u and ur partner. It PROTECTS Zambia. 60pcnt protection from HIV could make the difference. SMS about otha benefits	Hi U-Reporter! Ur counselor has lots of info on the benefits of MC and great clinics to go to! Not sure about something? Have a worry? Then text ur question!	U-Reporter, R u ready for MC? Do you know where you will go? Or when? Text ur counselor now 4 help, or even just encouragement.
3-Oct	U-Reporter! Meds and proper will make MC ez 4 u. Ask ur counselor where to go for safe MC clinics near you, open weekdays and weekends too.	Zambian MEN are going 4 MC! Ur generation cares about dere health, n U-Reporters r leading the way! Text ur counselor 2 hear some reasons why men hav gone 4 MC.	Hi! MC is a safe procedure available 4 free at many clinics, wit experienced providers. Text ur counselor 4 mor info on wats involved when you decide 2 go.	Wat is holdin u back from MC? SMS ur counselor now n see if they can help u. Before u go, get the info u need to know! SMS ur counselor.
5-Oct	Hi! MC does not take 4 eva, and you won't feel pain durin the procedure. There r many sites to choose from, so ask ur counselor if ur preferred clinic offers MC.	Hi U-Reporter! Plan for ur healthy future… think ahead! There r many ways 2 reduce risk of HIV and STIs, n MC provides u with an EXTRA layer of defence.	Hi! MC does not take 4 eva, and you won't feel pain durin the procedure. There r many sites to choose from, so ask ur counselor if ur preferred clinic offers MC.	Hey U-Reporter! Be PREPARED b4 u go 4 MC! SMS ur counselor 2 find out wat 2 expect when u go to the clinic and how u can get ready

Appendix B: Survey instruments

Baseline SMS survey



Recurring SMS survey



Note: Some questions were worded slightly differently across the three follow-up surveys

Semi-structured interview: interview guide questions

General questions

Basic Demographics

How old are you?

What is your tribe?

What neighbourhood do you live in?

Basis for U-Report Participation

How did you learn about U-Report?

Why did you choose to sign up for U-Report?

Interview Participation

How did you learn about this interview opportunity?

Are you using the same phone line that you received the interview invitation on?

Do you ever share the phone number you are using with other people?

Tell me about how the phone is shared

Can you give an example?

Do you use multiple phone numbers?

How often do you use different phones?

Why do you choose to use different phones?

Do you use your U-Report registered phone number more often?

General experience with U-Report

Overall, how satisfied are you with U-Report? Has the service met your expectations?

As you know, the purpose of U-Report is to give young people access to information regarding sexual health related to HIV/AIDS and STIs. Do you think this has been achieved?

What is one thing you DO NOT like about U-Report, or that you would change or improve?

What is the MOST USEFUL ASPECT of U-Report for you personally?

Have you texted a question to U-Report counsellors in the past?

What did you think about the quality of the response you received?

Did a U-Report counsellor ever help you to make a decision? Can you give an example?

If you had to choose between continuing to receive awareness messages from U-Report (Not responses to questions) OR continuing to ask your own questions to counsellors, which aspect of U-report would you keep?

Interaction with U-Report

Sometimes U-Report sends messages providing information about health topics. Have you received messages like that in the past?

What do you think about these health messages? Do the messages apply to you?

Do you read the messages you receive from U-Report? How often and why?

Do you ever talk to your friends, family, or partner about the messages you receive?

U-Report surveys

You may have noticed that U-Report sometimes sends surveys to U-Reporters, which are a series of questions for participants to answer. Sometimes 2 kwacha is sent to the people who respond. Have you answered survey questions in the past? What were the questions about?

Why did you, personally, choose to respond to questions from U-Report?

Are there more reasons you can think why OTHER people might respond to the surveys?

Why do you think U-Report sends survey questions? What do you think is the purpose?

What is your opinion of the surveys?

Do you think SMS surveys are a useful way for U-Report to learn about U-Reporters like you?

When U-Report sends survey questions to people like you, how reliable do you think the responses are to each question? For example, when U-Report asks people if they are circumcised or if they went for HIV testing, do you think other U-Reporters give accurate answers?

How often do you think people give false information? Why?

Have YOU ever given non-serious or false responses to a U-Report survey? Why?

VMMC questions

Have you ever received messages from U-Report about male circumcision [besides during SMS *surveys*]?

VMMC Knowledge

hat is male circumcision?

What are some ADVANTAGES or BENEFITS of male circumcision?

What are some DISADVANTAGES of male circumcision?

Do you know what amount of protection circumcision provides from HIV?

Do you know how much MC costs at government clinics in Zambia?

What is the healing time for male circumcision? (How long do you abstain from sex?)

Do you know of clinics that provide male circumcision? Which ones? Where did you learn that they offered MC?

VMMC Uptake

Are you personally circumcised?

If YES:

What were your main reasons for going?

WHERE did you go for MC? Why did you decide to go there?

WHEN did you go for MC? [*help caller figure out the approximate month when they went*]

Tell me more about what influenced your decision to go for MC at that time.

When did you first decide that you wanted to go for MC? Did anything trigger your decision?

Can you describe to me your personal experience going for MC at the clinic? [look for: whether booking was made; alone or with others; waiting time; clinic attendance levels; complaints or feedback for MC providers or health staff]

Did U-Report play any role in your decision to go for VMMC? If so, how?

If NO:

Do you have any intention to go for MC in the future?

If intention:

What would be your MAIN REASONS for going?

When did you FIRST DECIDE you wanted to go for MC? Was it a hard decision?

Did someone or something you heard CONVINCE you to go for MC? Who or what convinced you? Did U-Report play any role? If so, how?

WHEN do you think you might go for MC?

Do you know WHERE you will go to get MC? If yes, where?

If no intention:

What is your reason for not wanting to go for MC?

Can you think of anything that would ever change your mind?

U-Report VMMC campaign (for those who received campaign)

As you noticed, U-Report has been sending messages about male circumcision over the past six months as part of an experimental campaign. We're interested in your feedback on this campaign.

Do you think it made sense to use U-Report to promote MC with messages? Was the campaign a good use of U-Report? Why?

Do you think SMS messages, like the ones on U-Report, can influence people's decision to go for MC? Why or why not?

Do you think SMS messages promoting MC are any different from other messages that are on TV, the radio, or billboards? If yes, what makes them different?

When U-Report sends messages about topics like MC, how important is it for U-Report to have SMS counsellors available for people to have their questions answered? Why?

If the MC campaign were run again, what would you change about it? [ask about: message content; number of messages sent; length of campaign period]

Appendix C: Pre-analysis plan

U-Report VMMC: Analysis Plan and Protocol

Latest version: 16 September 2014

Background

This document is designed to define the U-Report VMMC study's protocol for analysing and managing data, while also providing guiding context on the study's setup and objectives.

The U-Report platform, operated by UNICEF Zambia and CHAMP in cooperation with the National HIV/AIDS Council, is designed to provide young people with free access to information on HIV/AIDS and STIs. Its functionalities include (1) the ability to send informational and promotional messages; (2) free and confidential interaction with trained counsellors; (3) the ability to poll enrolees with policy-relevant questions; (4) the collection of self-supplied data over time via enrolment, responses to polls and interactions with counsellors.

Funded under 3ie's Thematic Window 3 for evaluations of pilot programmes promoting demand for adult circumcision, the study's primary aim is to measure the impact on MC uptake of two U-Report campaign variants in Zambia's Lusaka Province, with a sample frame of relevant platform enrolees.

Study aims and objectives

The main goal of this evaluation is to produce rigorous evidence on SMS behaviour change communication that can directly inform national VMMC-promotion strategy as well as UNICEF's own programming in Zambia and other countries. A second goal is to contribute to a global evidence-base towards more cost-effective and impactful interventions in the realm of VMMC demand creation and SMS-based behaviour change.

Primary aim:

- Measure the impact of two SMS-based promotional/informational campaigns on VMMC uptake among 'Zambia U-Report' participants in Lusaka Province.

Secondary aims:

- Measure the impact of two SMS-based promotional/informational campaigns on self-reported intention to receive VMMC among 'Zambia U-Report' participants in Lusaka Province.
- Obtain qualitative and operational insights on SMS-based VMMC behaviour change to guide potential scaled-up operationalisation or programme modification, or to inform other demand-generation projects
- Measure impact of the campaign (in terms of VMMC uptake and intention) on different types and groups of participants

- Measure the impact of two SMS-based promotional/informational campaigns on platform deactivations (un-subscription)

Design and study setup

Design: The U-Report VMMC evaluation is designed as a three-armed randomised controlled trial, with behaviour change communication (in the context of an SMS platform providing confidential counsellor access) targeted at the level of the individual.

1. 'Routine' group: control participants will continue to have 'business as usual' access to U-Report, without any special VMMC promotional activities

2. 'Conventional intervention' group: participants will all receive the same standard package of promotional and informational SMS messages about VMMC.

3. 'Comprehensive intervention' group: depending on their self-reported intention to receive VMMC (30 days, 6 months), re-evaluated every 2 months, participants will receive customised packages of promotional and informational SMS messages about VMMC.

Sample: The study's sample frame consists of uncircumcised males aged 15–30 years old in Lusaka and Chongwe Districts, who are enrolled on U-Report as determined via self-reported data from U-Report registration (age, sex, district) and a baseline survey (circumcision status).

The U-Report subscribers from Lusaka will have been enrolled through routine, non-study-specific platform recruitment, largely through mass media PSAs. Since policymakers are also interested in the impact of these campaigns in peri-urban areas, we will bolster U-Report enrolment in Chongwe through on-the-ground efforts in preparation for the study.

From the sample frame, up to 2,550 eligible individuals will be randomly selected for participation, stratified by district. All eligible participants in Chongwe will be included in the sample, and the remainder will come from Lusaka.

Sample size update (6 May 2014): Because of a higher than anticipated percentage of U-Reporters reporting that they were circumcised at baseline, the sample was limited to 2,312 U-Reporters.

Arm assignment: Final study participants will be stratified into eight groups and randomly assigned within each stratum to one of three study arms. Participants will be stratified by the following three criteria:

- District (Lusaka vs. Chongwe)
- Age (under 18 vs. 18 and over)
- VMMC intention (intention to receive VMMC in the next 2 months vs. no such intention)

Protocol: Assign random number (0-1) to each study participant. Divide into eight groups according to the stratification criteria. Within each stratum, based on random number, top third of participants are assigned to Group 1, next third to Group 2, final third to Group 3. Remainders in each stratum are randomly assigned to one of three groups, with no two going to the same group within same strata. Each of the three groups is randomly assigned an EVALUATION arm.

Primary Analysis

Overview

A) Outcome indicator
    a. VMMC uptake
        i. Self-reported
        ii. Verified
B) Data sources
    a. SMS survey responses: Self-reported VMMC uptake; intention-level to receive VMMC, and other covariates
    b. Client-level data: MC Register and Client Record Form data, from providers and facilities, for verification of self-reported data
C) Quantitative analysis methodology
    a. Logit regression, controlling for select covariates, with sensitivity analyses around uncertainties

Analysis framework

For each pair of study arms, multiple logit regression analysis will be used to measure the effect of a binary treatment condition on the binary dependent variable.

Potential covariates will be available from enrolment data (district; neighbourhood; age), the baseline survey (baseline intention to receive VMMC; phone sharing behaviour), and midline and endline surveys after the campaign's launch. As described above, some covariates will be necessarily balanced across study arms in advance via stratified random assignment.

In the final regression analysis, the following covariates may ultimately be controlled for, as available:

- District
    - Neighbourhood
    - Age
    - Date of U-Report enrolment

- Platform activity prior to and during campaign (number of conversations started)
- Phone sharing (e.g. whether phone is shared with family)
- Multiple phone usage
- Intention to receive VMMC at some point (at baseline, 2 months, 4 months)
- Intention to receive VMMC within 2 months (at baseline, 2 months, 4 months)
- Relationship status
- Educational attainment
- Circumcision uptake by immediate family members
- Tribe

Most of the covariates will be included in the regression as dummy variables, as will treatment assignment, using the control arm as the reference group.

Population weights by district – based on the proportion of study participants to the estimated eligible district population – may be applied to the regression.

The following logit regression model will be used to estimate the causal relationship of respective treatment arm conditions on VMMC uptake (versus control, or versus each other):

$$\Pr(Y=1 \mid X1, X2, X3 \ldots Xk) = \frac{1}{1+e^{-(\beta 0+ \beta 1X1+ \beta 2C2+ \beta 3C3 +\cdots+ \beta_k C_k)}}$$

Where:

- Y is self-reported and/or verified VMMC uptake
- β0 … β*k* are constant coefficients
- X1 is a binary variable for treatment condition (vs. control, or other treatment condition)
- C2 … C*k* are covariates

In Stata 12, the following code framework will be used to identify the impact and significance of each permutation of treatment conditions:

logit y_var treatment_condition covar1 covar2 covar3 … covarX

<u>Sample management: attrition, alterations, and validity considerations</u>

Dealing with attrition/missing data

Attrition and missing data can come from several sources:

- General unresponsiveness to surveys, and the endline survey in particular
- Revealed ineligibility
- U-Report deactivation

- Obliged requests to stop receiving campaign messages and/or surveys

In the case of statistically significant deviations in attrition levels across evaluation arms, potential bias in the analysis will be highlighted for context and also mapped quantitatively under several assumptions (conservative, middle-of-the-road, and liberal). Using covariates, analysis may also be informed by comparing respondents to non-respondents, and by examining missing participants' previously self-reported intention-levels.

***Protocol for participants wishing to drop out of campaign or study*:

- Some participants may request to stop receiving either messages about MC or surveys. These requests will be obliged, and some data will be missing as a result.

***Protocol for participants who are discovered to not fit criteria for participation*:

- Data or participant responses may reveal through the course of the study that some participants should not have been included in the final sample, perhaps due to misrepresentation of sex, age, district, or MC status at time of baseline. ONLY participants deemed ineligible due to sex or status at time of baseline will be dropped from the analysis. Participants with unclear baseline circumcision statuses (e.g. inconsistently reported circumcision uptake prior to baseline survey) will be included and excluded from alternative analyses.

***Protocol for missing data*:

- Most recent midline poll responses may partially substitute for missing endline data (e.g. a participant who intends to go for MC 'at some point' at 4 months may be presumed to have the same level of intention at the endline)

- When individuals fail to respond to midline polls but do respond to endline polls, the missing midline data may be inferred as possible. (This shouldn't affect any major analysis.)

- *Missing covariate data*: A pre-analysis including only participants with no missing covariate data (e.g. education, relationship status, etc.) will be conducted to gauge the importance of covariates. Afterwards, observations with missing data may be included in the analysis with 0s replacing data for existing dummy variables, and 1s entered for new dummy variables for missing data by survey question. We have decided against imputing missing values, given the limited number of covariates that we will have available to us.

External validity

Some baseline participants are excluded from the sample frame due to unresponsiveness to the baseline poll. Many of these individuals will be uncircumcised, and there is sufficient reason to believe that these individuals would have responded differently to the VMMC campaign than participants more willing to engage with U-Report. A comparison

will be done to identify differences between study and non-study U-Reporters based on available registration data to help inform the study's external validity.

Levels of analysis and sensitivity analysis

Sub-sample analyses

In addition to examining the effects of treatment conditions using the entire sample, the final impact analysis may also be carried out on predefined sub-samples of the population that are policy-relevant:

- Lusaka participants
- Chongwe participants
- Participants less than 18 years old (guardian consent required for MC)
- Participants at least 18 years old
- Participants who report intention to receive MC at some point (at baseline)
- Participants who report intention to receive MC within 2 months (at baseline)
- Participants who report intention to receive MC within 2 months (at some point in first three SMS surveys)
- Participants who report no intention to receive MC (at baseline)

Since the study is not powered to detect differences among sub-samples of the population, this analysis is meant to be exploratory to examine indications of heterogeneity of treatment effects.

Analysing self-reported data

The main outcome variable is self-reported data that is considered reliable. Therefore, assumptions and different sources of evidence are required to inform a final criterion for *which* self-reported uptake is taken to be (likely) valid. Additionally, alternative analyses (with different criteria for counting self-reported data as reliable) will be very important to test the sensitivity of the study's findings to different assumptions.

To assess validity, we will use a ranking …. Or we will use different definitions of self-reported uptake …

The following cross-cutting aspects of self-reported uptake will be analysed and considered for use in alternative analyses, especially where unreliability of treatment group responses is indicated/suggested vis-à-vis control group responses. The criteria will be evaluated against each other and in conjunction with other evidence (e.g. validated data).

Considering reported data differently according to the criteria can also be used to estimate actual uptake from different angles.

- Period of uptake
    - Prior to baseline survey (before 16 April)
    - Between baseline survey and campaign launch (16 April–7 May)

    - After campaign launch

- Clarity / precision of reports

    - Site and date of uptake clearly and precisely reported
    - Site and/or date of uptake ambiguously or imprecisely reported

- Consistency of reports

    - Consistently reported status, consistently reported uptake by site and date
    - Consistently reported status, inconsistently reported uptake by site and/or date
    - Inconsistently reported status, or contradiction via message to U-Report counsellors[33]

- Estimated 'coherency' of SMS survey respondents

    - 'Coherently' reported intention levels
    - 'Less coherently' reported intention levels (e.g. jumps between near intention and no intention; jumps from no intention to uptake)

- Response consistency to un-subjective questions (e.g. age)

    - Consistent age response
    - Inconsistent age response

First, self-reports categorised according to the above criteria will be compared across study arms – testing for statistical significance – in order to see possible usefulness for analysis in cases where unreliability may explain differences across groups rather than campaign effects. For example, if self-reported uptake prior to the baseline is truthful and accurate, then there shouldn't be any differences in uptake across study arms during that period (before any treatment condition was introduced). A higher proportion on ambiguous responses by treatment group participants could also suggest a greater degree of treatment group response unreliability.

Qualitative data from participant interviews will be leveraged to inform the usefulness of the categories above at indicating reliability/unreliability.

Incorporating verification data into analysis

Some self-reported VMMC uptake will be validated with client data. Verified uptake will comprise an outcome that can be used in the analysis in several ways:

1. To construct a lower bound of the campaign's impact on VMMC uptake

2. To inform the reliability of different types of self-reports

[33] Contradiction via message to U-Report counsellors can help us explore issues of reliability. It will not be used as a hard and fast component of any consistency ranking since it relies on a U-Reporter's initiative to message counsellors.

3. To detect possible bias in self-reporting (if statistically different proportions of uptake are verified across study arms)

An assumption of the analysis – which may or may not be tested – will be that participants will not inaccurately report *NOT receiving* MC. However, data verification activities will test a hypothesis that participants also do not inaccurately report *receiving* MC.

Verification of self-reported VMMC uptake will be attempted for all self-reports, as possible, by matching study participant data against all available client data, resulting in all uptake either being verified or unverified. Unverified self-reports may be contextualised and treated differently based on the following cross-cutting aspects relating to verifiability.

- Ambiguity / precision of report
    - Site reported
    - Month and/or date reported
- Site access
    - Identification of site reported
    - Presence of site in study area
    - Access to site data
- Data availability and quality
    - Missing data (estimated on at least a month-by-month basis using VMMC register)
    - Recorded phone numbers

The proportion of data verified at strongly ‘verifiable’ sites across study arms may be applied to construct more realistic bounds to reflecting the verification rate expected if verifiability limitations were removed. This is especially relevant to cases where client data is absent or missing for the sites/dates reported, and less so to ambiguous self-reports.

Using Qualitative Data to Inform Analysis

Interviews are investigating the reliability of self-reported data. Findings will inform modifications to the analyses presented below.

Primary Analysis

The primary regression analysis will look at the impact of treatment conditions on reported uptake treated as ‘reliable.’ The results will be adjusted for any treatment-group biases detected.

Definitions:

- Uptake reports are defined as CONSISTENT if circumcision statuses, uptake sites, and uptake months (or uptake dates within 10 days) are consistently (and unambiguously) reported at least two times AND if no other survey reports are contradictory AND if no messages to counsellors are contradictory

Rules:

- Count only consistently reported uptake OR verified uptake as reliable uptake
- Drop observations having consistently reported uptake OR verified uptake prior 8 May (campaign start date was 7 May)

Data Adjustments:

- Reports made during the 6-month survey in the September–October period cannot be checked for consistency. Therefore, the May–August consistency rate will be applied to the Sept–Oct reports in order to model a realistic net number of reliable reports in each study arm
- Accounting for possible bias
    - Statistically significant (5 per cent level) differences in the rate of verified uptake between the control group and the two treatment groups (taken together) will be evaluated as bias in self-reported uptake.
    - Statistically significant (5 per cent level) differences in the number of participants reporting consistent uptake prior to the baseline survey will be evaluated as desirability bias (or possibly bias due to misinformation).
    - Detected biases above will be averaged and applied to the treatment groups taken together, modelling a realistic net number of participants believed to have gone for VMMC in each study arm.

Primary Lower Bound

- Verified uptake (modelled outwards based on proportion of strongly and weakly 'verifiable' reports verified)

Primary Upper Bound

- All self-reported uptake after campaign start, adjusted for bias if identified

Alternative Analyses

Alternative analyses, with different rules for including/excluding data, will be made to contextualise the primary analysis and provide variations on upper/lower bounds, to assess the sensitivity of the results to different assumptions, and to explore that data in ways that could raise new questions.

- Strict analysis on report period only

- Strict analysis on report consistency only
- Treatment of all self-reported data as valid

Secondary Analyses

Quantitative

Important secondary quantitative analyses include, but are not strictly limited to, measurement of the following

- Programme effect on U-Report deactivation
    - Regression measuring treatment conditions' impact on deactivation
- Programme effect on intention-to-receive VMMC
    - Regression measuring treatment conditions on self-reported endline intention (or change in intention/uptake status)
- Relevance of intention-to-receive VMMC to actual VMMC uptake
    - Correlation between self-reported intention and ultimate uptake
    - Percent of those who say they will obtain MC who do obtain MC
- Predictors of VMMC uptake
    - Within treatment arms, regression measuring covariate impact and relevance to uptake
- Association of counsellor engagement with VMMC uptake
    - Regression measuring impact of counsellor engagement (frequency/occurrence and intensity of questions to counsellors) on VMMC uptake
- Interplay between prompting messages and counsellor uptake
    - Correlation of informational/promotional message delivery with counsellor engagement
    - Ranking of messages according to apparent effect on counsellor engagement

Qualitative

Qualitative data collection and analysis will have several ends:

- To assess the reliability of self-reported data
- To inform the mechanisms of interventions' successes or lack of successes, especially in terms of the theory of change, and on different sub-sample groups

- To obtain insights on the effectiveness of specific campaign components (e.g. impact of individual messages; satisfaction with counselling)
- To help construct campaign counterfactuals *beyond* the scope of the study period

Several qualitative tools will be used:

- Semi-structured interviews: Up to 60 interviews will be conducted with participants in order to understand the mechanisms of campaign impact at the level of the individual. Questions may be constructed around individuals' specific characteristics and study outcomes.
- Campaign monitoring/observation: U-Reporter activity will be monitored and recorded throughout the campaign. Representative or distinctive U-Reporter interactions can serve as vignettes. Some pathways to behaviour uptake may be traced/documented through questions to counsellors.
- Focus group discussion: Counsellor insight will be obtained through a focus group discussion around what counsellors perceived to work or not work in impacting uptake. Counsellors can also give feedback on campaign messaging based on their interactions with U-Reporters.
- Stakeholder anecdotes: Perspective can be collected from stakeholders involved in campaign implementation/oversight, especially to document operational experiences/insights.

Some questions to be explored include:

- How would those who obtained VMMC have behaved in the absence of the campaign?
- What barriers to uptake were/are characteristic of participants who did/didn't obtain VMMC?
- What barriers to uptake were/weren't addressable by the campaigns?
- What do participants recall from the campaign? What knowledge have participants retained?
- How were different messages perceived?
- How relevant and tailored were messages to participants?
- How was campaign content shared/discussed with other non-participants? Friends? Significant others? Family?
- How useful were counsellors?
- How have the interactions affected current or expected future engagement with U-Report (beyond VMMC)?

Appendix D: Sample size and power calculations

The target sample size of 2,550 participants was determined by balancing availability of eligible participants while also seeking to ensure a minimum detectable effect size of no more than 3 percentage points for a high-range projection of control group uptake at 2.0 per cent, comparing two out of three arms against another. Twenty per cent attrition was modelled into the power calculation. These calculations were done using Optimal Design version 3.0 (Optimal Design Software, Arlington Heights, IL, USA).

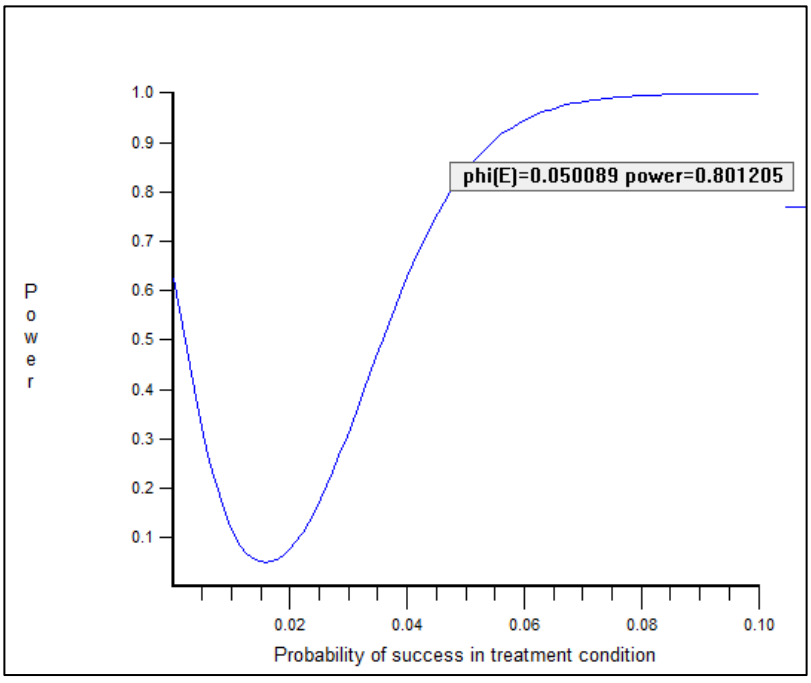
Retrospective power calculations are provided in section 8.

Power calculation parameters, inputs and outputs

Parameters	Primary calculation	Alternative #1	Alternative #2
Power	80%	80%	80%
Alpha	5%	5%	5%
Control probability	2.0%	1.0%	0.5%
95% plausibility interval	0.25-7.0%	0.25-7.0%	0.25-7.0%
Minimum detectable effect size	3.0%	*2.4%*	*1.6%*
Treatment probability	5.0%	*3.4%*	*3.4%*
Sample size	*1,360*	1,360	1,360
1. Adjusted sample (before 20% attrition)	*1,700*	1,700	1,700
2. Adjusted sample (3 arms)	*2,550*	2,550	2,550

Note: Inputs in bold, *outputs* italicised.

Primary power calculation for probability of control group uptake at 2.0 per cent



Appendix E: Additional results

Full results of self-report outcomes

Uptake by study arm for self-reported data (inconsistency-based outcome criteria)

	All reports (N=1,566)			No status-inconsistency (N=1,652)			No status- or site-inconsistency (N=1,652)			No inconsistency (status, site or date) (N=1,652)		
	No.	%	dif	No.	%	dif	No.	%	dif	No.	%	dif
Study arms												
Control	101	19.5%	--	79	14.4%	--	77	14.0%	--	57	10.4%	--
Conventional	123	22.8%	+3.3%	86	15.1%	+0.7%	83	14.6%	+0.6%	66	11.6%	+1.2%
Tailored	131	25.8%	+6.3%	97	18.2%	+3.8%	89	16.7%	+2.7%	67	12.6%	+2.2%

Logistic regression results for self-reported data (inconsistency-based outcome criteria)

Covariates	MODEL #1 All reports			MODEL #2[P] No status-inconsistency			MODEL #3 No status- or site-inconsistency			MODEL #4[P] No inconsistency (status, site or date)		
	Odds ratio	p-value	[95% CI]	Odds ratio	p-value	[95% CI]	Odds ratio	p-value	[95% CI]	Odds ratio	p-value	[95% CI]
Study arm												
Control	ref			ref			ref			ref		
Conventional	1.28	0.11	[0.95,1.73]	1.11	0.56	[0.79,1.55]	1.09	0.62	[0.77,1.53]	1.17	0.41	[0.80,1.72]
Tailored	1.47	**0.01**	[1.09,1.99]	1.34	0.08	[0.96,1.86]	1.24	0.22	[0.88,1.73]	1.24	0.28	[0.84,1.81]
Covariates												
Two-month intention	2.16	**0.00**	[1.68,2.77]	2.11	**0.00**	[1.60,2.77]	2.04	**0.00**	[1.54,2.69]	1.95	**0.00**	[1.43,2.66]
Adult	1.03	0.90	[0.63,1.70]	1.21	0.52	[0.67,2.18]	1.14	0.67	[0.63,2.04]	0.99	0.97	[0.53,1.85]
Chongwe District	1.57	**0.03**	[1.04,2.36]	1.46	0.09	[0.94,2.27]	1.41	0.13	[0.90,2.21]	1.56	0.07	[0.97,2.52]
Circumcised family members	1.68	**0.00**	[1.30,2.16]	1.60	**0.00**	[1.21,2.13]	1.65	**0.00**	[1.24,2.21]	1.50	**0.02**	[1.08,2.08]
High-uptake tribe	1.18	0.25	[0.89,1.57]	1.42	**0.02**	[1.05,1.93]	1.30	**0.10**	[0.95,1.78]	1.43	**0.04**	[1.01,2.02]
No. of surveys responded	1.17	0.09	[0.98,1.40]	0.86	0.11	[0.71,1.04]	0.84	0.07	[0.69,1.01]	0.67	**0.00**	[0.55,0.82]
Constant	0.08	**0.00**	[0.03,0.17]	0.13	**0.00**	[0.05,0.31]	0.15	**0.00**	[0.06,0.36]	0.26	**0.00**	[0.10,0.66]

[P] Models used for primary analyses of self-reported data.

* All participants reporting uptake prior to campaign period dropped from analysis.

Uptake by study arm for self-reported data (consistency-based outcome criteria)

	Consistent status (N=1,415)*			Consistent status and site (N=1,415)*			Consistent status, site and rough date (N=1,415)*			Consistent status, site and precise date (N=1,415)*		
	No.	No.	%	No.	%	No.	No.	%	dif	No.	%	dif
Study arms												
Control	37	7.7%	--	32	6.7%	--	10	2.10%	--	6	1.30%	--
Conventional	39	8.0%	0.3%	36	7.4%	0.7%	18	3.70%	+1.6%	8	1.60%	+0.3%
Tailored	49	10.9%	3.2%	38	8.4%	1.7%	18	4.00%	+1.9%	7	1.60%	+0.3%

Logistic regression results for self-reported data (consistency-based outcome criteria)

	MODEL #5 Consistent status (Four-month data) (N=1,415)*			MODEL #6 Consistent status and site (Four-month data) (N=1,415)*			MODEL #7[P] Consistent status, site and rough date (Four-month data) (N=1,415)*			MODEL #8 Consistent status, site and precise date (Four-month data) (N=1,415)*		
Covariates	**Odds ratio**	**p-value**	**[95% CI]**	**Odds ratio**	**p-value**	**[95% CI]**	**Odds ratio**	**p-value**	**[95% CI]**	**Odds ratio**	**p-value**	**[95% CI]**
Study arm												
Control	ref			ref			ref			ref		
Conventional	1.10	0.69	[0.68,1.78]	1.17	0.53	[0.71,1.94]	1.99	0.09	[0.90,4.42]	1.50	0.47	[0.50,4.45]
Tailored	1.44	0.12	[0.91,2.27]	1.26	0.36	[0.77,2.07]	1.90	0.12	[0.85,4.21]	1.16	0.79	[0.38,3.56]
Stratifying covariates												
Two-month intention	1.80	**0.00**	[1.23,2.64]	1.65	**0.02**	[1.10,2.50]	1.91	**0.04**	[1.04,3.49]	1.79	0.20	[0.74,4.36]
Adult	1.38	0.47	[0.58,3.27]	1.40	0.48	[0.55,3.59]	3.14	0.26	[0.42,23.4]	1.36	0.77	[0.18,10.5]
Chongwe District	1.83	**0.04**	[1.02,3.28]	1.74	0.09	[0.92,3.28]	1.99	0.12	[0.84,4.73]	2.50	0.12	[0.79,7.96]
Other covariates												
Circumcised family members	2.24	**0.00**	[1.52,3.30]	2.41	**0.00**	[1.58,3.67]	2.87	**0.00**	[1.51,5.48]	4.23	**0.01**	[1.50,11.9]
High-uptake tribe	1.99	**0.00**	[1.34,2.96]	1.77	**0.01**	[1.15,2.72]	2.97	**0.00**	[1.62,5.46]	4.53	**0.00**	[1.86,11.0]
No. of surveys Responded	1.32	0.23	[0.84,2.07]	1.74	**0.04**	[1.03,2.94]	1.26	0.53	[0.61,2.64]	1.94	0.30	[0.55,6.83]
Constant	0.01	**0.00**	[0.00,0.06]	0.00	**0.00**	[0.00,0.03]	0.00	**0.00**	[0.00,0.03]	0.00	**0.00**	[0.00,0.03]

[P] Model used for primary analysis of self-reported data

* Participants who only responded to one follow-up survey excluded from analysis (no possibility reports being backed up)

Appendix F: Cost data and analysis

Estimated cost of setting up and running Zambia U-Report

SETUP COSTS				
Description	**Unit amount (ZMW)**	**Unit amount (US$) [1]**	**Unit**	**Total (US$)**
Equipment				
Desktop computer	6,000	952	3	2,857
IP telephone handset	500	79	1	79
Servers (IP PABX)	200,000	31,746	1	31,746
Printer	1,000	159	1	159
Setup activities				
Recruit 2 U-Report SMS counsellors & 1 U-Report project officer	5,000	794	1	794
Train 2 U-Report counsellors, and one U-Report project officer	33,920	5,384	1	5,384
Workshop to develop/update U-Report knowledge bank	73,700	11,698	1	11,698
Publicity campaign	630,000	100,000	1	100,000
Personnel costs				
Lead developer	25,200	4,000	1	4,000
Project manager	31,500	5,000	1	5,000
TOTAL				**161,717**
OPERATIONAL COSTS				
Description	**Unit amount (ZMW)**	**Unit amount (US$)**	**Unit**	**Total (US$)**
Equipment				
Equipment maintenance[2]	10,000	1,500	1	1,500
IT consumables	1,200	190	1	190
Short code annual license	22,680	3,600	1	3,600
Annual SMS costs	504,000	80,000	1	80,000
Cloud-based server	3,780	600	1	600
Internet (per month)	6,300	1,000	12	12,000
Personnel				
Project manager (monthly)	31,500	5,000	12	60,000
U-Report programme officer (monthly)	12,416	1,971	12	23,649
2 SMS counsellors (monthly)	7,261	1,153	12	13,830
TOTAL				**195,370**

[1]Based on exchange rate of 6.3 ZMW / US$
[2]Amount is based on assumption

Cost analysis

A cost-effectiveness analysis was completed to examine each intervention's cost per additional circumcision. The analysis uses a model that measured both the cost and number of circumcisions that would be achieved if all U-Reporters were exposed to one of three options that largely mimicked what each evaluation scenario would look like at scale-up (*Model for Cost-Effectiveness Analysis*). The analytic time-horizon for this campaign was six months with 21 campaign messages sent during this time. Probabilities that were used in the model were largely based on evaluation results (*Probability inputs for cost-effectiveness model*).

Model for cost-effectiveness analysis

Male U-Reporters	**TAILORED**		Circumcised - no campaign	Already circumcised
		Response	Pr(BLMC_resp)	Already circumcised
		Pr(Resp)	Not circumcised - campaign sent	Pr(BLMC_mis) Circumcision
			1-Pr(BLMC_resp)	Pr(MC_tail) No circumcision
	Survey sent			1-Pr(MC_tail) Already circumcised
				Pr(BLMC_all) Circumcision
		No Response	Campaign	Pr(MC_conv) No circumcision
		1-Pr(Resp)		1-Pr(MC_conv)
	CONVENTIONAL		Circumcised - no campaign	Already circumcised
		Response	Pr(BLMC_resp)	Already circumcised
		Pr(Resp)	Not circumcised - campaign sent	Pr(BLMC_mis) Circumcision
			1-Pr(BLMC_resp)	Pr(MC_conv) No circumcision
				1-Pr(MC_conv) Already circumcised
				Pr(BLMC_all) Circumcision
		No Response	Campaign	Pr(MC_conv) No circumcision
		1-Pr(Resp)		1-Pr(MC_conv)
	CONTROL			Already circumcised
				Pr(BLMC_all) Circumcision
				Pr(MC_ctrl) No circumcision
				1-Pr(MC_ctrl)

Tailored scenario
The tailored scenario assumed that all male U-Reporters would be sent a baseline survey that would consist of up to three questions: 1) Are you circumcised? 2) If no, do you intend to get circumcised? 3) If yes, do you intend to get circumcised within the next three months? U-Reporters who respond to the survey and are not yet circumcised receive a tailored campaign based on level of intention. Since the fixed cost of designing a campaign is already included, this scenario assumes that a standard set of messages covering intention levels and behaviour change tactics would still be sent to non-responders. Outcomes for U-Reporters who received the tailored campaign were assumed to reflect the same uptake rates that we saw in tailored arm of the evaluation, while outcomes for non-responders who received the standard set of messages would reflect the same uptake rates that we saw in the conventional arm of the evaluation.

Conventional scenario
The conventional scenario assumed that all male U-Reporters would be sent a one question baseline survey that asks if the U-Reporter is circumcised. Those who either report not being circumcised or who do not respond at all would be sent a standard set of SMS messages. Outcomes for those who received messages were assumed to reflect the uptake levels that were detected in the conventional arm of the evaluation.

Control scenario
The control scenario assumed that all male U-Reporters would have standard access to U-Report counselling services but would not receive any promotional VMMC messages through U-Report. Outcomes were assumed to mimic those of the control arm uptake.

All three scenarios made some common assumptions. First, they assumed that all U-Reporters were male and all were unique individuals that were already circumcised at baseline, were circumcised at the end of the six months, or remained uncircumcised at the end of the six months. Second, they assumed that U-Reporters who self-reported that they were circumcised at the time of the baseline survey were actually circumcised. Third, they assumed that some U-Reporters would report not being circumcised though they likely were at the same percentage that was detected in the evaluation. Fourth, they assumed that uptake probabilities did not differ between those who responded to a baseline survey and those who did not respond to a baseline survey.

Probability inputs for cost-effectiveness model

	DESCRIPTION	VALUE	NOTES
Pr(Resp)	% who respond to survey	0.2	47% of U-Reporters responded to the evaluation baseline survey, but this was with a 2 ZMW incentive. Surveys that U-Report has sent in the past with no incentive have yielded ~15%. We assumed 20%.
Pr(BLMC_resp)	% who respond that they are circumcised at baseline	0.571	Evaluation findings
Pr(BLMC_mis)	% who respond that they are UNCIRCUMCISED at baseline but who actually are	0.114	Evaluation findings
Pr(BLMC_all)	% who are circumcised at baseline, regardless of response	0.620	Pr(BLMC_resp) + [1-Pr(BLMC_resp)]*Pr(BLMC_mis)
Pr(MC_tail)	% of uncircumcised males who get circumcised after receiving a tailored campaign	0.126	Self-reported uptake (scenario 4) in tailored arm
		0.011	Verified uptake in tailored arm
Pr(MC_conv)	% of uncircumcised males who get circumcised after receiving a conventional campaign	0.116	Self-reported uptake (scenario 4) in conventional arm
		0.018	Verified uptake in conventional arm
Pr(MC_ctrl)	% of uncircumcised males who get circumcised without a campaign	0.104	Self-reported uptake (scenario 4) in conventional arm
		0.015	Verified uptake in conventional arm

Costs

Input costs regardless of the scenario were based on operational U-Report costs over a six-month time horizon. Additional scenario-specific costs included fixed survey and campaign costs, variable (per person) survey and campaign costs, and variable non-campaign costs from counsellor engagements. To account for costs incurred at the societal level, an assumed US$10 transport cost for each circumcision was applied for transport to and from the facility for the procedure, as well as follow-up appointments. Additionally, we used data from the Zambia Ministry of Health to estimate the cost of service delivery.

INPUTS			
Variable	**Description**	**Value**	**Notes**
total	Number of U-Reporters	73,854	Source: U-Report
pct_male	% of male U-Reporters	0.580	Source: U-Report
time_tail	Time to programme tailored survey (days)	7	Source: Personal correspondence with U-Report programmer
time_conv	Time to programme conventional survey (days)	3	Source: Personal correspondence with U-Report programmer
prog_salary	Programmer salary (per day)	200	Source: Personal correspondence with U-Report programmer
time_mess	Person time for message development (days)	5	Assumption based on evaluation experience
mess_salary	Message developer salary (per day)	160	Assumption based on evaluation experience
pct_nointent	% with no intent	0.190	Evaluation findings
pct_intent	% with some intent (> 2 mos & w/i mos)	0.810	Evaluation findings
mess_nointent	# of exchanges for no intent	2	Question + response
mess_intent	% with some intent (> 2 mos & w/i mos)	4	2 questions + 2 responses
mess_campaign	Number of campaign messages	21	
counsel_ctrl	Number of counselling messages per person (control)	1.300	Based on non-evaluation U-Report activity - accounts for incoming and outgoing messages
counsel_conv	Number of counselling messages per person (conventional)	7.980	Based on non-evaluation U-Report activity - accounts for incoming and outgoing messages
counsel_tail	Number of counselling messages per person (tailored)	9.260	Based on non-evaluation U-Report activity - accounts for incoming and outgoing messages
nonresp_factor	Number of counselling messages per non-responder	0.500	Assumes non-responders would be less engaged on U-Report by this factor
sms	Cost per SMS sent	0.020	Source: U-Report
transport	Transport cost per circumcision	10	Source: Republic of Zambia Ministry of Health, 2012. Country Operational Plan for the Scale-up of Voluntary Medical Male Circumcision in Zambia, 2012 – 2015
service_A	Service delivery cost at Level A facility	53.73	Source: Republic of Zambia Ministry of Health, 2012. Country Operational Plan for the Scale-up of Voluntary Medical Male Circumcision in Zambia, 2012 – 2015
service_B	Service delivery cost at Level B facility	61.09	Source: Republic of Zambia Ministry of Health, 2012. Country Operational Plan for the Scale-up of Voluntary Medical Male Circumcision in Zambia, 2012 – 2015
service_C	Service delivery cost at Level C facility	100.89	Source: Republic of Zambia Ministry of Health, 2012. Country Operational Plan for the Scale-up of Voluntary Medical Male Circumcision in Zambia, 2012 – 2015

COSTS			
	Description	**Value**	**Calculation**
	Base population	42835.3	total x pct_male
	Fixed tailored survey cost	1400	time_tail x prog_salary
	Fixed conventional survey cost	600	time_conv x prog_salary
	Fixed campaign cost	800	time_mess x mess_salary
	Number of survey messages per uncircumcised tailored response	3.620	(pct_nointent x mess_nointent) + (pct_intent x mess_intent)
	Variable cost of sending survey & receiving 1st message	0.040	2 x sms
	Variable cost of add'l tailored responses (among respondents)	0.072	[(pct_nointent x mess_nointent) + (pct_intent x mess_intent)] x sms
	Variable counselling cost in control group (among responders)	0.026	counsel_ctrl x sms
	Variable counselling cost in tailored group (among responders)	0.185	counsel_tail x sms
	Variable counselling cost in conventional group (among responders)	0.160	counsel_conv x sms
	Variable counselling cost in control group (among non-responders)	0.210	counsel_ctrl x sms x nonresp_factor
	Variable counselling cost in tailored group (among non-responders)	0.093	counsel_tail x sms x nonresp_factor
	Variable counselling cost in conventional group (among non-responders)	0.080	counsel_conv x sms x nonresp_factor
	Societal cost per circumcision	81.9033	(service_A + service_B + service_C) / 3 + transport

These cost calculations were based on a few assumptions. First, it was assumed that all U-Reporters who started a survey would finish the survey. Second, costs account for messages that are sent to U-Report outside of survey responses since it is likely that campaign messages stimulate more SMS engagement with counsellors. These estimates were based on activity levels that were detected in each evaluation arm. Third, non-responders were assumed to still engage on the U-Report platform at an engagement level that is one half of what was observed in the evaluation. Finally, the base model cost for each scenario accounts for 6 months of observational costs but does not account for any of the initial set-up costs.

The model estimated the number of new circumcisions that would occur over a six-month period under each of the three scenarios, as well as the cost of each scenario using U-Report's perspective. In other words, the model does not account for costs experienced or saved by society from the circumcision procedure or costs saved from HIV cases averted. Cost-effectiveness of each scenario was determined by comparing the total cost to the total number of new circumcisions. An incremental cost-effectiveness ratio (ICER) was calculated for the conventional scenario and for the tailored scenario using the control scenario as a comparison to obtain the cost per additional VMMC:

$$ICER = \frac{(Cost_{intervention} - Cost_{control})}{New\ circumcisions_{intervention} - New\ circumcisions_{control}}$$

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This study assessed the impact of two five-month short message service (SMS) campaigns designed to increase the uptake of voluntary medical male circumcision (VMMC) in urban Lusaka and peri-urban Chongwe district, Zambia. The campaigns were conducted with Zambia U-Report, a free and confidential SMS platform designed for subscribers to access information and SMS counselling on sexual health issues. In the 'conventional' campaign, all participants received the same comprehensive package of messages. In the 'tailored' campaign, participants received messages targeted towards their level of intention to get circumcised.

Overall, both campaigns did not significantly increase the self-reported and verified VMMC uptake. However, the campaigns had large impact on counsellor engagement and demand for information on VMMC. Future research is still necessary to fully understand the potential of SMS-based tools for VMMC demand creation.

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