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GUIDELINES



GUIDELINE ON
**THE USE OF DEVICES
FOR ADULT MALE
CIRCUMCISION FOR HIV
PREVENTION**

OCTOBER 2013

MALE CIRCUMCISION
FOR HIV PREVENTION

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Declaration of interest forms were collected from every member of each guideline development group and the WHO Technical Advisory Group on Innovations in Male Circumcision (TAG) according to the established WHO procedures. The main potential conflicts of interest were intellectual. The WHO secretariat determined that there were no conflicts or potential conflicts that would require exclusion from discussions and/or development of the recommendation. The members of the Guideline Development Group who also have a capacity with a donor agency provided inputs as technical experts and were not considered as representatives of their respective donor agencies. At the WHO TAG meeting, only members were present for the final discussion and decisions regarding the clinical efficacy and safety of each specific device that was evaluated.

ACRONYMS AND ABBREVIATIONS

AE	adverse event
CI	confidence interval
GHTF	Global Harmonization Task Force
GRADE	Grading of Recommendations, Assessment, Development and Evaluation
HIV	human immunodeficiency virus
ISO	International Organization for Standardization
MC	male circumcision
MOH	ministry of health
PMS	procurement and supply management
RCT	randomized controlled trial
SD	standard deviation
SAE	serious adverse event
STI	sexually transmitted infection
TAG	Technical Advisory Group on Innovations in Male Circumcision
UNAIDS	Joint United Nations Programme on HIV/AIDS
VAS	Visual Analogue Score
WHO	World Health Organization

EXECUTIVE SUMMARY

Male circumcision reduces a man's risk of heterosexual acquisition of HIV by about 60%. In 2007 the World Health Organization (WHO) and Joint United Nations Programme on HIV/AIDS (UNAIDS) recommended that medical male circumcision services should be a priority additional intervention in the HIV prevention strategies of countries with a high prevalence of HIV and a low prevalence of male circumcision.

A number of East and Southern African countries have added male circumcision to their HIV prevention programmes. Progress has been constrained, however, due to challenges such as the shortage of surgically trained providers, the time required for the current conventional surgical circumcision method and uncertain client demand. Recently, innovations in male circumcision device technologies have emerged that promise to make the procedure simpler, less resource-intensive, usable by non-physician health care providers, acceptable to clients and providers, and have the potential to expand coverage, thus maximizing prevention.

This guideline provides an evidence-based recommendation on the use of adult male circumcision devices for HIV prevention in public health programmes in high HIV prevalence, resource-limited settings. It also presents key programmatic considerations for the introduction and use of these devices in public health HIV prevention programmes. The primary audiences are policy- and decision-makers, programme managers, health-care providers, donors and implementing agencies.

The guideline was developed according to the *WHO standards and requirements* for guideline development. The process involved internal and external consultations with technical experts, national programme managers, consumer advocates and a evidence review methodologist.

The consensus from consultations led to the following recommendation:

WHO prequalified male circumcision devices are efficacious, safe and acceptable as additional methods of male circumcision for HIV prevention among healthy men 18 years and older in high HIV prevalence, resource-limited settings (conditional recommendation, moderate quality evidence).

This recommendation applies in settings where:

- a) the devices are used by health-care providers, including physicians and mid-level providers, who are appropriately trained and competent in the use of the specific device; and
- b) surgical backup facilities and skills are available as appropriate to the specific device.

A recommendation on device use with younger male adolescents (less than age 18 years) will be considered when additional data become available.

The recommendation is based on the evaluation of two specific devices, an elastic collar compression device and a collar clamp device, as sufficient data were available only on these two devices from studies in Africa to assess clinical efficacy and safety according to the *WHO framework for clinical evaluation of devices for male circumcision*. Insufficient data were available to evaluate other devices.

Listing of a specific device as “prequalified” by the WHO Prequalification for Male Circumcision Devices Programme provides assurance that the specific device meets global standards of quality, safety and efficacy. “Prequalified” does not imply WHO approval or endorsement of a particular device; that is the sole prerogative of national programmes. The list of specific prequalified device(s) is available on the WHO web site (www.who.int/diagnostics_laboratory).

The strength of the recommendation was made based the quality of the evidence, the balance of anticipated benefits and harms, the values and preferences of clients and health-care providers and resource implications. A conditional recommendation (rather than strong) was made primarily on concerns about potential harms, in particular device slippage and displacements, when devices are used in routine health-care settings, for which there was not yet sufficient evidence. Uncertainty about some aspects of patient acceptability and programme costs also warranted a conditional recommendation.

The balance of benefits versus harms

A smaller proportion of men were eligible for circumcision with a device (93–98%) than by surgery. Similarly high levels of successful circumcisions were achieved with devices as with conventional surgery. Healing following a device method was by secondary intention and took one to two weeks longer than with surgery. The frequency of adverse events with devices was no higher than with surgery. A few adverse events, namely device displacements or device placement failures, required immediate or urgent surgical intervention to prevent potential long-term serious outcomes. A device-based procedure took less than half as long as surgery, even including the time for removal of the device at the second visit. Trained mid-level providers, including nurses, achieved similar outcomes as trained physicians. The levels of pain reported with devices were similar to or lower than the levels reported with surgery.

Programmatic considerations

Once approved for use in a country, national programmes should introduce prequalified male circumcision devices in a phased manner and involve all key stakeholders in a participatory process. Pilot demonstration projects should be conducted under routine operating conditions to show the feasibility (including costs), safety and acceptability of device use in country-specific contexts and to refine service delivery approaches. Participation of key stakeholders in planning and implementation will enhance sustained political commitment, country ownership and the likelihood that pilot projects will lead to successful scale-up.

Policies and regulations will need to be reviewed and perhaps revised to support device use. Unnecessary restrictions on the cadres of health-care providers authorized to use the devices may hamper scale-up and should be avoided. A national safety monitoring system should be established to ensure patient safety as programmes are rolled-out.

Any service delivery site using a device must have appropriately trained staffing, facilities, equipment, commodities and a referral system to assure safe placement and removal of the device as well as management of device events such as placement failures or displacements. To manage such events, timely surgical back-up services must be available. The use of devices does not obviate the need for surgical services for men not eligible for device circumcision, or for clients who prefer a surgical method.

Male circumcision devices have the potential to accelerate the delivery of medical male circumcision services by simplifying the procedure, increasing the number and type of health care workers who can perform the procedure, and offering a method that may improve client acceptability and enhance demand.



1. INTRODUCTION AND BACKGROUND

Three randomized controlled trials, conducted in Kenya, Uganda and South Africa, have demonstrated that male circumcision (MC) reduces the risk of heterosexually acquired HIV infection in men by about 60% (1-3). Based on this evidence, and extensive observational research, in 2007 the World Health Organization (WHO) and the United Nations Joint Programme on HIV/AIDS (UNAIDS) recommended medical male circumcision (MC) as a priority additional intervention for prevention of heterosexually acquired HIV infection in men in settings where the prevalence of heterosexually transmitted HIV is high and the prevalence of male circumcision (MC) is low (4). Accordingly, 14 countries in East and Southern Africa are engaged in the scale-up of medical male circumcision (5).

Recent findings from post-trial observational studies in the three countries where the original trials were conducted remain consistent and compelling. The protective effect of MC was sustained at 4.8 years and 6 years among trial participants in Rakai, Uganda and Kisumu, Kenya, respectively (6, 7). Five years into the roll-out of a voluntary medical MC community intervention in Orange Farm, South Africa, the prevalence of circumcision among males 15 – 49 years had risen from 12% to 53% and HIV incidence was estimated to be 60% lower among circumcised men compared with among uncircumcised men (8).

A modelling study has suggested that reaching, and then maintaining, 80% prevalence of male circumcision among men 15 to 49 years old in 13 priority countries could prevent 3.36 million HIV infections by 2025, saving an estimated US\$16.5 billion in lifetime HIV treatment costs (9). Such a scale-up over 2011–2015 would entail performing about 20 million circumcisions; an additional 8.4 million circumcisions would be needed between 2016 and 2025 to maintain 80% coverage. The cost would total US\$2 billion between 2011 and 2025.

Medical MC is a one-time intervention resulting in lifelong lower risk of HIV infection in men, unlike other prevention interventions such as condom use or pre-exposure prophylaxis, which require on-going use and adherence. However, the scale-up of medical MC has varied across the 14 countries (10). A number of challenges account for the limited pace of progress, particularly a shortage of human resources, the time required for the current conventional surgical circumcision method, and uncertain client demand.

Specifically, shortage of surgically skilled health-care providers remains one of the major obstacles (11-13). Policies that restrict the performance of minor surgeries such as adult male circumcisions to physicians limit the pace of MC scale-up in some countries implementing medical male circumcision for HIV prevention in (13, 14). A range of strategies have been developed to alleviate this human resource challenge (12), including:

- revising scopes of practice for clinical officers and nurses to allow task-shifting (15)
- redeploying public-sector staff temporarily during medical MC campaigns (16)
- expanding the health workforce through recruitment of unemployed, recently retired, newly graduating, or on-leave health-care providers (16) and
- integrating medical MC services into routine health services so that primary health-care providers can provide the services (17).

Innovations in service delivery, such as the Models for Optimizing the Volume and Efficiency of Male Circumcision Services (MOVE), have helped several countries to improve the efficiency with which a health-care team can deliver conventional surgical MC services while maintaining quality and safety (18).

Recently, innovations in male circumcision device technologies have emerged that have the potential to reduce the time and resources required for medical MC, facilitate the provision of the service by non-physician providers, increase acceptance by health-care providers and clients and improve the safety of the procedure, thus potentially accelerating the expansion of MC for HIV prevention.

In 2010 WHO established a Technical Advisory Group on Innovations in Male Circumcision (TAG) to review and advise WHO on technological innovations, including devices. Based on inputs of the TAG, the *Framework for the clinical evaluation of devices for male circumcision* was developed which describes the clinical evaluation pathways required to provide sufficient evidence of the efficacy and safety of a new male circumcision device (19).

The TAG also agreed on the following three categories of in situ MC devices, classified by their mechanism of action (for which the required data to inform this guideline were available on two types of devices: a collar clamp and an elastic collar compression):

Clamp devices: The mechanism of action is a rapid, tight compression of the foreskin between hard surfaces to achieve haemostasis. Compression is sufficient to prevent slippage of tissue so that the foreskin can be removed at the time of, or soon after, placement of the device. Part of or the entire device is left in situ for a period of time to prevent bleeding. Because the device crushes the foreskin upon placement, and live tissue is excised immediately after device placement, injection of local anaesthesia is required for pain control. This category includes two subcategories: collar clamp devices and vice clamp devices.

Elastic collar compression devices: The mechanism of action is a slow compression of the foreskin between an elastic ring and a hard surface that is sufficient to occlude circulation and produce tissue ischaemia, devitalization and necrosis. Part of or the entire device and the foreskin are left in position after device placement until the foreskin necroses and can be excised. This type of device can be applied without injected local anaesthetic.

Ligature compression devices: The mechanism of action is a rapid compression of the foreskin held tightly between a ring placed under the foreskin and a non-rigid ligature tied around the outside of the foreskin. Compression is sufficient to achieve haemostasis and prevent slippage of tissue so that the foreskin can be removed at the time of, or soon after, device application. Part of or the entire device is left in situ. Because the device crushes the foreskin, and live tissue is excised immediately after placement, local anaesthesia is required. The compression force and the security of the knot depend on the dexterity and skill of the provider.

Surgical assist MC devices are not classified as in situ devices. They are used during a surgical circumcision and are removed from the body by the end of the procedure. These MC devices are not considered in this guideline.

WHO established the Prequalification of Male Circumcision Devices Programme in 2011. The Programme aims to promote and facilitate equitable access to safe, appropriate and affordable male circumcision devices of good quality. The Prequalification Programme ascertains whether a specific device has met relevant international standards in terms of product performance, the manufacturer's quality management system, and clinical safety and efficacy. Once the assessment is complete and the overall findings demonstrate that the product meets the WHO prequalification requirements, the specific device manufactured at a specific site is listed as "prequalified", providing assurance of quality and making the device eligible for procurement by United Nations (UN) agencies, WHO Member States, donors and other purchasers such as the Global Fund. "Prequalified" does not imply WHO approval or endorsement of a particular device; that is the sole prerogative of national programmes.



2. SCOPE OF THE GUIDELINE

This document provides guidance on the use of devices for adult male circumcision for HIV prevention in public health programmes in high HIV prevalence, resource-limited settings. This guideline is intended to:

- provide countries with an evidence-based recommendation on the use of adult male circumcision devices as a method for medical MC for HIV prevention;
- present key programmatic considerations for the introduction and use of MC devices in public health HIV prevention programmes.

This guidance is intended for use by:

- policy- and decision-makers
- national HIV programme managers
- providers of medical male circumcision services
- donors and implementing agencies.

Dissemination of the guideline

This guidance will be available electronically on the WHO web site (www.who.int/hiv/topics/malecircumcision) and the Clearinghouse for Male Circumcision for HIV Prevention web site (www.malecircumcision.org). Also, it will be sent electronically to policy-makers, to WHO Regional and Country offices and to programme managers, clinicians and researchers known to be working on the male circumcision intervention for HIV prevention. A limited number of print copies will be available on request through WHO and at national and international conferences. WHO will hold a guideline dissemination workshop in one of the East or Southern African countries and provide technical support to Member States upon request. One measure of the effectiveness of the guideline will be the uptake and safety of medical MC with device methods through monitoring in national programmes.

Updating the guideline

This guideline on the *Use of devices for adult male circumcision for HIV prevention* will be updated to reflect new evidence that becomes available from research, implementation and experience with scale-up. WHO will maintain contact with researchers to determine the availability of new evidence. A subgroup of the TAG will determine if the data are sufficient for full review. It is estimated another review will occur in 2014.

3. PROCESS FOR DEVELOPMENT OF THE GUIDELINE

The guideline were developed according to WHO standards and requirements for guideline development (20).

3.1 Establishing guideline groups

Three groups were set up to develop the guidance:

- The WHO Guideline Steering Group on Male Circumcision Devices, chaired by the WHO Department of HIV/AIDS, to lead the guideline development process;
- The Guideline Development Group, composed of external content experts, national HIV programme managers, economists and representatives of civil society, to provide inputs throughout all stages of the guideline development process; and
- The External Review Group, composed of individuals interested in male circumcision for HIV prevention, to provide inputs and perspectives at selected stages of the guideline development process and review the final draft of the guidance.

The TAG is an established advisory group of the Department of HIV/AIDS; it provides advice on technical innovations in male circumcision, the type and quality of evidence required for evaluation, identifies further research needed, and it reviews data from clinical studies. A face-to-face meeting of the TAG took place in January 2013 for an in-depth review of data on the safety, efficacy and acceptability of the two MC devices for which sufficient data were available. At that meeting the TAG also advised WHO on key programmatic considerations that guidance should address. The TAG was represented in both the Guideline Development and External Review Groups to ensure an accurate understanding and consideration of the TAG's assessment and conclusions in the final recommendation and programmatic considerations.

3.2 Defining the scope of the guidance

The WHO Steering Group and the Guideline Development Group agreed on the scope of the guideline and on the key question and outcomes that would guide the search for and the analysis of evidence and the drafting of the resulting recommendation(s). The key question was:

Among adolescent¹ and adult men seeking circumcision for HIV prevention in a high HIV prevalence, resource-limited setting, are male circumcision devices a safe, efficacious and acceptable method for circumcision compared with conventional surgical male circumcision?

Clinical trials have already established that male circumcision—adequate removal of the foreskin—is highly efficacious in the prevention of heterosexually acquired HIV infection in men, reducing risk by about 60% (1-3, 21). Therefore, the current review focused on the efficacy and safety of MC devices to ensure the adequate removal of foreskin and did not address the impact of MC on HIV incidence.

¹ Adolescents are defined by WHO as young people between the ages of 10 and 19 years. Data were only available on males age 18 years and older, and therefore, the final recommendation is for males 18 years and older.

3.3 Prioritizing outcomes

A list of potential outcomes of interest was circulated among a subgroup of the Guideline Development and External Review Groups. Each reviewer scored the importance of each outcome on a scale of 1 to 9:

- 1 to 3 to indicate an outcome considered not important
- 4 to 6 to indicate an outcome considered important
- 7 to 9 to indicate an outcome considered critical.

The individual scores received were then averaged to determine the relative importance of each outcome. The reviewers considered the following outcomes critical:

- eligibility for device circumcision
- successful circumcision
- moderate and serious adverse events
- healing time.

Outcomes considered important included:

- pain at different points in time
- final cosmetic result at different times post-procedure
- procedure time.

3.4 Defining the priority outcome measures

The TAG developed the following definitions for the outcome measures:

Eligibility was defined as the proportion of men who met the criteria for conventional surgical circumcision and were also eligible for circumcision with the specific device and in whom the device could be successfully placed.²

Successful circumcision was defined as removal of sufficient foreskin such that the coronal sulcus was visible with the penis in a flaccid (non-erect) state. Circumcision failures included clients who needed additional intervention to complete the circumcision or when insufficient foreskin was removed. The proportion of successful circumcisions was calculated based on clients on whom the device was successfully placed.

Adverse events (AEs). AE classification schemes evolved over the course of the studies as more information became available on the nature of AEs that were seen with device use. Different mechanisms of action of devices and surgical procedures led to differences in the types and characterization of AEs. The TAG agreed on a standard terminology and classification scheme to facilitate the compilation and assessment of AEs across studies. In doing so, the TAG was guided by the principles and definitions of the International Organization for Standardization and the Global Harmonization Task Force (22):

² All men must be screened for medical eligibility for circumcision, in particular for the absence of any penile abnormalities and current genital infections. For a particular device, use may be further restricted due to: a) additional anatomical reasons, such as phimosis (inability to retract the foreskin), a narrow foreskin opening or a short fraenum; or b) technical reasons that preclude device placement such as unavailability of the correct device size or inability to complete the device placement procedure.

- Any untoward medical occurrence, unintended disease or injury, or untoward clinical signs (including an abnormal laboratory finding) in subjects, users or other persons, whether or not related to the conventional surgical procedure or to the medical device used for performing or assisting in the male circumcision procedure, was considered an AE.
- Any AE that was definitely not related to the circumcision procedure or to handling or operating the medical device was not considered further.
- Any AE was considered a serious AE (SAE) if it satisfied the GHTF definition of an SAE:
 - 1) led to a death; or,
 - 2) led to a serious deterioration in the health of a patient, user, or others that:
 - a) resulted in a life-threatening illness or injury
 - b) resulted in a permanent impairment of a body structure or a body function
 - c) required in-patient hospitalization or prolongation of existing hospitalization
 - d) resulted in medical or surgical intervention to prevent permanent impairment to a body structure or a body function.
- Any AE not classified as a SAE but which required an intervention by a health care provider or medication (parenteral, oral or topical) was considered a Moderate AE;
- All AEs that did not require intervention were considered Mild AEs.

Time to healing was defined as the number of days from the date of conventional surgical circumcision or device placement (not from the date of intended or actual device removal) to the first date when complete wound epithelialization was observed. Not all study teams used identical definitions of complete wound healing, and the long intervals between visits in some studies prevented a precise estimate of the duration of healing.

Pain was measured in most studies using a Visual Analogue Score (VAS) with a range of 0–10, where 0 corresponds to “no pain at all” and 10, to “worst pain imaginable”. Clients were shown pictograms for six different rating levels, with accompanying text usually translated into the local language (see Figure 1).

Figure 1. Visual analogue pain scale and pictograms



The pain assessments were made at specified time points, depending on the study and the follow-up schedule, such as during device placement; after placement; while wearing; during and after removal; and at selected follow-up visits. Not all studies assessed pain at the same time points; the most comparable times have been selected in order to facilitate comparisons among devices and with conventional surgical circumcision. Additionally, some studies assessed the duration of the pain.

Procedure time. For device methods, procedure times were calculated as the sum of the preparation and procedure times for placement and removal, not counting the time between the two. Procedure times were measured from start of the procedure to completion of wound dressing ('first to last touch') for conventional surgery or to end of device placement (last touch) for device application; procedure times did not include the time for induction of anaesthesia, where used. Device removal times were measured from first touch to completion of wound dressing after device removal.

3.5 Retrieving the evidence

The WHO secretariat formulated a comprehensive search strategy in an attempt to identify all studies, regardless of language or publication status (published, unpublished, in press, or in progress), relevant to the safety, efficacy and acceptability of MC devices. These are detailed in Annex 1 on the WHO website.

In addition to conducting online searches for relevant studies using common electronic databases, the WHO secretariat contacted investigators known to be studying the use of MC devices in African countries. Unpublished confidential reports of completed studies and interim reports of on-going studies were made available to WHO for review by the TAG. The study investigators provided clarifications where necessary.

Additional evidence to inform values and preferences, resource use and costs was based on literature reviews in PubMed and contact with key investigators. Key stakeholders and experts within the guideline development groups were contacted for their opinions regarding the acceptability of MC devices compared with that of surgical MC.

3.6 Selection of studies and evidence synthesis

The TAG reviewed evidence from research on the two types of devices for which there was sufficient data to assess clinical efficacy and safety according to the WHO *Framework for the clinical evaluation of devices for male circumcision*. The Framework requirements include:

- initial studies to establish the safety and acceptability of the device;
- at least two independent randomized controlled trials comparing the device with an established method of surgical circumcision performed by providers skilled to offer either method of male circumcision in settings of intended final use; and,
- at least two field studies on the device involving relevant populations and types of facilities, performed by suitably trained and qualified mid-level or non-physician providers in settings of intended final use.

The WHO secretariat, with inputs from the TAG, used the data from the individual eligible studies to generate an estimate of effect for each of the priority outcomes. Insufficient data were available to evaluate any other devices.

3.7 Rating the evidence

The WHO secretariat, with inputs from methodologists, used the GRADE (Grading of Recommendations, Assessment, Development and Evaluation) methodology to rate the quality of evidence (high, moderate, low or very low) for the critical outcomes (20). In keeping with the GRADE approach, evidence profiles were prepared. Evidence that was based on randomized controlled trials (RCTs) was generally classified as high quality, but the rating was downgraded if the WHO secretariat judged that there was a risk of bias, inconsistency of results, indirectness of evidence, imprecision or publication bias. The evidence from observational studies was not formally categorized but was used to support and supplement the evidence obtained from the randomized studies.

3.8 Developing the recommendation

With the support of a methodologist, the WHO Guideline Steering Group reviewed the evidence profiles and prepared a draft recommendation for consideration by the Guideline Development Group. The Steering Group assessed the strength of the recommendation based on:

- the quality of the evidence (i.e. the confidence in the findings of the studies)
- the balance between anticipated benefits and harms
- the values and preferences of clients and health-care providers (i.e. the acceptability of MC devices)
- resource use and the cost implications of adding MC devices to existing voluntary medical MC services.

The Guideline Development Group and External Review Group reviewed the recommendation. Consensus was reached through e-mail, telephone consultations and two ad hoc meetings held during a sub-regional workshop in Africa.

3.9 Producing the guidance

The WHO secretariat drafted the guidance which includes both the recommendation as well as programmatic considerations. Draft versions of the guidance were circulated to members of the guideline development groups. All responses were considered in the final draft of the guidance. Overall, there was full consensus on the recommendation and the minimal variability was dealt with in small group discussions until consensus was achieved.

4. THE EVIDENCE

The evidence used to inform the recommendation was restricted to data on devices that met the full set of required studies as detailed in the Framework for clinical evaluation of devices for male circumcision (see section 3.5) (19). The evidence included data on two devices of different types: one collar clamp device and one elastic collar compression device. Two evidence profile tables can be found in Annex 2 (available on the WHO website), one for each device. For each type of device and for each priority outcome, the table provides estimates of effect generated from the data pooled across the studies. These tables reference the individual studies from which data were extracted to generate each estimate. Key points on each costing study reviewed are also included in Annex 2 (available on the WHO website). In the findings below, references are indicated only when one or a selection of the studies, rather than all studies, was used for the estimates.

4.1 Clinical evaluation of the collar clamp device

4.1.1 Overview of the studies

The clinical studies reviewed by the TAG included data on the safety, efficacy and acceptability of one collar clamp device. The studies took place in China and three countries in Africa—Kenya, Uganda and Zambia. Early studies in China demonstrated that the device was safe and efficacious in Chinese study participants (ages 5 to 95 years across Chinese studies) when applied under local anaesthesia by skilled providers (23-27). These studies formed the basis for proceeding in a stepwise manner to clinical research in African countries where public health male circumcision programmes are being implemented.

The studies that met the criteria of the Framework and were reviewed by the TAG included two initial safety and efficacy studies, two randomized controlled trials and two field studies (28-36). These studies provided directly relevant information on the clinical performance of the device when used in public health HIV prevention programmes. All the studies conducted in Africa used the same device design, which differed from the original device with regard to the mechanism to secure the outer ring. In Africa the safety and effectiveness of the collar clamp device have been studied only in men age 18 years and older.

The African studies are summarized in Table 4 of the January 2013 TAG report (19).

4.1.2 Priority outcomes

Eligibility

The overall estimated proportion of men eligible for the device was 98.8%³. This proportion is based on (1) the 99.6% of clients considered eligible for circumcision with the collar clamp device among those eligible for conventional surgical MC; and (2) the 99.2% of 1998 participants in whom the device procedures were started and completed (all but 15 men). Incomplete procedures were due to correct ring size not being available at the time of the procedure (8), the foreskin slipped from the outer ring (3), the foreskin was too short (1) or was damaged (2), or the outer ring could not be closed.

Among the seven men (0.4%) in whom the device placement procedure was started but could not be completed, all were converted to surgical circumcision. For the three men in whom the device placement failure occurred after removal of the foreskin, had facilities not been immediately available to safely complete the open circumcision (sterile field, sutures or electrocautery for haemostasis and sutures for wound closure), complications that could have resulted in SAEs might have occurred.

Successful circumcision

Circumcision was achieved in all 1983 clients on whom the device was successfully placed, with the exception of 3 men (0.15%) who were considered to have insufficient skin removed. A study examining spontaneous detachment of the device showed that, if the device was not removed as scheduled at seven days, the device began to detach and came off spontaneously (28). There were no serious problems encountered if the device remained in place longer than seven days. Partial detachments were reported to cause pain and discomfort, because the partially detached device pulls away from live tissue or may snag and cause tearing of tissue and bleeding. Therefore, the device ideally should be removed at seven days.

Adverse events

Based on 1983 successful device placements across all studies, there were:

- zero SAEs—0.0% (95% confidence interval (CI): 0.0–0.2%)
- 20 moderate AEs—1.0% (95% CI: 0.6–1.6%)
- 43 mild AEs— 2.2% (1.6–2.9%).

The frequency of AEs using a device was no higher than for conventional surgery. In a study comparing the device to conventional surgery, based on 197 successful device placements and 198 surgical circumcisions, the following AEs were recorded (31, 34, 35):

- zero SAEs in either arm
- two moderate AEs, both in the surgical arm
- 23 mild AEs, 15 in the device arm and 8 in the surgical arm ($p=0.4$).

Across all studies, the moderate AEs i.e. those requiring medical or surgical intervention, were uncommon (less than 1 in every 100 procedures) (19). Pain requiring intervention by health care workers, such as administration of additional medication for control, comprised the bulk of AEs classified as moderate. Pain is discussed as a separate priority outcome below.

³ The proportion 98.8% was calculated as the product of 99.6% and 99.2%

A small number (<1%) of wound disruptions occurred several weeks after device removal; these were departures from the normal healing process.

Healing time

Healing following male circumcision took one week longer than after surgery. Healing is by secondary intention rather than primary intention (as is the case for surgical MC, in which the wound edges are approximated with sutures). In the comparative study the mean time to complete healing was 44.1 days (SD 12.6) following collar clamp device placement compared with 38.9 days (SD 12.6) following surgery (mean 5.2 days longer, 95% CI: 2.7–7.7 days) (31, 34, 35).

Pain

The level of pain reported during device placement and in the post-procedure period was similar to that reported with conventional surgery. A collar clamp device is designed to avoid the need for sutures for haemostasis during surgery and to clamp the skin edges firmly together to fuse as part of the healing process. Because of the tight clamping mechanism and because the foreskin is cut away during the procedure, local injectable anaesthesia is required before device placement as it is for conventional surgery. In addition to pain during the anaesthetic administration, men reported some pain while wearing the device and a somewhat higher level of pain during erection than at comparable times after conventional surgery. Men also reported a short, transient discomfort or pain as the device was removed. Partial detachment of the device caused some discomfort or pain, but this was rare if the device was removed as scheduled at seven days.

Procedure time

The overall mean time to place the device was 6.4 minutes (SD 3.8), excluding the time for injection and induction of local anaesthesia. The mean removal time was 3.1 minutes (SD 1.8). In the RCT the total of the mean placement and removal times (mean 10.3 minutes) was less than the mean procedure time for conventional surgery (mean 20.3 minutes) (31, 35).

Cosmetic result, deemed an important outcome, is reported under the values and preferences section.

4.2 Clinical evaluation of the elastic collar compression device

4.2.1 Overview of the studies

The clinical studies reviewed by the TAG provided data on the safety, efficacy and acceptability of one elastic collar compression device when applied by skilled providers in three countries—Rwanda, Uganda and Zimbabwe (37-46). The studies included two initial safety and efficacy studies, two randomized controlled trials, and two field studies, in Rwanda and Zimbabwe. The TAG also reviewed interim data from two field studies in Uganda. All studies were conducted among men age 18 years and older. These studies are summarized in Table 6 of the January 2013 TAG report (19).

4.2.2 Priority outcomes

Eligibility

The overall estimated proportion of men eligible for the device was 92.6%⁴. This proportion is based on (1) the 94.1% of clients considered eligible for circumcision with the elastic collar compression device among those eligible for conventional surgical MC; and (2) the 98.3% of 2268 participants in whom the elastic collar compression device procedures were started and completed (all but 38 men) due to narrow foreskin opening (16), tight or short foreskin (15) or adhesions (4), and three clients with a penis circumference size outside the range of available ring sizes.

Successful circumcision

A total of 2417 elastic collar compression devices were successfully placed in the eight studies. For a large majority of clients (99.5%), circumcision with the elastic collar compression device was successful, leaving a neat circumferential wound resulting in a final cosmetic appearance without suture marks. Circumcision had to be completed with surgical intervention in 12 clients (0.5%), 4 removed the device themselves on Day 1, 2 returned to the clinic on Day 2 requesting removal because of pain, discomfort or inconvenience, and in 5 clients the device became displaced on Day 1 (1), Day 2 (2), Day 4 (1) or Day 5 (1) following erection, masturbation, sexual intercourse or an assault. In one client surgery under local anaesthesia was required to remove the band of necrotic foreskin that had everted over the outer ring and prevented device removal.

Adverse events

AEs occurred in 42 men in whom the device was successfully placed (1.7%); the majority of AEs were mild or moderate, while 9 (0.4% of device placements) were considered serious, as prompt surgical intervention was required to prevent potential serious long-term sequelae. The nine adverse events categorized as serious resulted from device displacements during sexual activity, masturbation, erection; possible placement error; or accidental dislodging by another person; early removals (including self-removals) secondary to pain; meatal injury at removal; difficult removal due to necrotic tissue everted over the elastic ring requiring surgical intervention; and wound dehiscence. Some of the displacements involved pain, oedema and blistering as the blood flow returned to the partially necrotic foreskin; these required prompt surgical intervention to remove the foreskin and avoid serious infection or injury to the penis. A few men needed sutures at the time of removal to achieve haemostasis. In those cases injectable anaesthesia was used. No mechanical device failures were reported.

Healing time

Healing following male circumcision with the elastic collar compression device is by secondary intention. Healing took at least one week longer than after surgery. In one comparative study, the mean time to complete healing was 38.0 days (SD 12.1) following elastic collar compression device placement compared with 23.0 days (SD 7.5) following surgery (mean 15 days longer, 95% CI 12–18 days) (43). In another comparative study the difference in healing times was less pronounced, but interpretation of the data from this study was limited by the absence of follow-up visits between days 7 and 42 post-procedure in the surgical circumcision arm (40). The overall mean healing time after placement recorded

⁴ The proportion 92.6% was calculated as the product of 94.1% and 98.3%

over five studies was 42.3 days (SD 7.8). Thus, sexual abstinence (during healing) will be needed for a longer period of time than for standard surgical methods. Almost all men had healed by eight weeks.

Pain

The elastic collar compression device does not require injectable anaesthesia during placement. Comparing the pain scores is difficult because the pain control protocols evolved as the studies progressed and more information on pain became available. In none of the studies was routine injectable anaesthesia used for placement or removal of the elastic collar compression device (excluding the men with complications that required surgical intervention). A topical anaesthetic cream containing 5% lidocaine was first introduced in the Rwanda field study and has been adopted in all subsequent studies (38).

Summary results of the VAS pain scores in the Rwanda studies showed that pain was minimal at the time of placement of the elastic collar compression device (37, 38, 43). The period of greatest discomfort and pain was in three to six hours after placement, due to ischaemia induced by the device. Most study participants were given analgesics to take as needed at home after placement; in a large proportion of clients, medications such as paracetamol and ibuprofen appeared to control pain adequately during the early ischaemic process. The pain reported while the device was worn was less than at comparable times after conventional surgery, even during erections. During erection, a VAS pain score of at least 4 was reported by 20% of the clients circumcised surgically compared to 3% with the elastic collar compression device in situ ($p < 0.001$). Study participants reported transient but intense pain during device removal as the necrotic tissue was removed and the elastic and inner rings were detached from the healing wound; a mean of 43% of clients reported VAS scores of 4 or more.

Procedure time

There was considerable variation in placement and removal times over the different studies, with more experienced providers reporting lower procedure times. After the initial training and familiarization process, mean placement preparation times (across all studies) were 2.0 minutes (SD 0.8); placement procedure, 1.5 minutes (SD 1.0); removal preparation, 0.4 minutes (SD 0.2); and removal procedure, 2.0 minutes (SD 1.1). In the two comparative studies, the mean total procedure time (placement preparation and procedure times and removal preparation and procedure times) was 5.7 minutes (SD 1.4) compared with 19.2 minutes (SD 3.9) for conventional surgery (40, 43).

Cosmetic result, deemed an important outcome, is reported under the values and preferences section.

5. RECOMMENDATION

5.1 Key recommendation

WHO prequalified male circumcision devices are efficacious, safe and acceptable as additional methods of male circumcision for HIV prevention among healthy men 18 years and older in high HIV prevalence, resource-limited settings (*conditional, moderate quality evidence*).

This recommendation applies in settings where:

- the devices are used by health-care providers, including physicians and mid-level providers, who are appropriately trained and competent in the use of the specific device; and
- surgical backup facilities and skills are available as appropriate to the specific device.

Quality of the evidence: **Moderate**

Strength of the recommendation: **Conditional** in favour of the intervention

Devices prequalified through the WHO programme may include one or more devices with different mechanisms of action. Each specific device will have unique characteristics that must be considered in selection and use. Also, a WHO prequalification decision is time-limited. The products and manufacturing sites included on the WHO list of prequalified male circumcision devices will be reassessed at regular intervals and as warranted. Therefore, it is important to consult information on each device and the list of specific prequalified device(s) available at: www.who.int/diagnostics_laboratory.

A recommendation on device use with younger male adolescents (under age 18 years) will be considered when additional data become available.

5.2 Strength of the recommendation

The strength of the recommendation was made based on the quality of the evidence, the balance of anticipated benefits and harms, the values and preferences of clients and health-care providers and resource implications. A conditional recommendation (rather than strong) was made primarily on concerns about potential harms, in particular device slippage and displacements, when devices are used in routine health-care settings, for which there was not yet sufficient evidence. Uncertainty about some aspects of patient acceptability and programme costs also warranted a conditional recommendation.

5.2.1 Quality of the evidence

The evidence profile tables in Annex 2 (available on the WHO website) include a detailed quality assessment for each outcome. The tables include an explicit judgement of each factor that determined the quality of evidence for each outcome. Evidence from RCTs was rated separately. The evidence from the observational studies, while not rated separately, supplemented and validated the evidence obtained from the comparative trials as described below. In determining the overall quality of the evidence, only critical outcomes were considered.

Although the evidence apply only to men age 18 years or older and not the full age range of adolescent ages, the overall quality of the evidence was not downgraded for indirectness; rather, the recommendation was restricted to men age 18 years or over.

Combining the evidence for critical outcomes for both types of devices, the overall quality of evidence was rated as 'moderate', the lowest rating among critical outcomes. The overall judgement of the methodologist and the WHO secretariat was that further research would be unlikely to change the estimates of effect for eligibility, successful circumcision, and serious or moderate AEs, especially if evidence from the RCTs is supplemented by evidence from the observational studies. For healing times, the judgement was that, while further data might change the magnitude of the difference between devices and surgery, the main conclusion, that healing times were longer following device circumcision, would be unlikely to change.

5.2.2 Balance of benefits and harms

A smaller proportion of men were eligible for circumcision with a device (93–98%) than by surgery. Men ineligible for a device method would need conventional surgical male circumcision in order to obtain the HIV prevention benefit of circumcision.

Similarly high levels of successful circumcisions were achieved with devices (more than 99.5% efficacy) compared to conventional surgery. Unsuccessful device circumcisions were due to insufficient removal of the foreskin or the need to complete the procedure by a conventional surgical method.

Healing times for devices were one to two weeks longer than for surgical circumcision. There is theoretically a higher risk of HIV acquisition with unprotected sex before the wound is healed. However, modelling suggests that any increased risk associated with sex during the 6-week healing period is of negligible importance when compared with the reduced risk of HIV acquisition after the wound is healed—a benefit that lasts during the lifetime of sexual exposure (47). The extension of the healing period by an additional one or two weeks likewise has negligible additional impact.

When performed by appropriately trained health-care providers in appropriately resourced settings, the frequency of adverse events with devices was no higher than with conventional surgery⁵. The majority of adverse events associated with the use of devices were considered mild or moderate. A few events, including device displacements and slippage, required immediate or urgent surgical intervention to prevent potentially serious long-term outcomes.

5 All three landmark randomized trials on the effect of MC on the heterosexual acquisition of HIV assessed AEs associated with surgical MC. All three studies found AEs to be consistently low within the study environment (21). It is not possible to directly compare the occurrence of AEs across the different studies. In the South African study, AEs were recorded in 3.8% of men (60/1568) in the first month after circumcision. The AEs were not categorized by severity (1). In the Ugandan study AEs were observed in 7.6% of circumcised men (178/2328), of which almost half (47%) were considered severe or moderate (3). In the Kenyan study AEs were reported in 1.7% of men (24/1334) who were surgically circumcised; none of the events was classified as severe (2).

The levels of pain reported with devices was similar or lower to the levels reported after conventional surgery.

A device-based procedure took less than half as long as for the conventional surgical procedures. This included times for both device placement and removal.

5.3 Values and preferences of clients

5.3.1 Cosmetic result

Overall, men reported high levels of satisfaction with the cosmetic result of their circumcised penises, whether a device was used or conventional surgery was performed. The quality of data on cosmetic results was considered low due to indirectness and the risk of bias, as neither patients nor observers were blinded. For the elastic collar compression device, levels of satisfaction with the cosmetic result at six weeks or 90 days (depending on the study) were similarly high for both groups (39, 40). For the collar clamp type device, although men in both groups reported high levels of satisfaction, significantly more men in the device group reported being “very satisfied” than in the surgery group (31).

While devices may leave a more standardized circular wound appearance than conventional surgical methods at two weeks, six weeks, 60 or 90 days post-procedure, and they leave no suture marks, longer-term data—for instance, at one year post-procedure—on cosmetic outcomes were unavailable for any method.

Finally, the effect on acceptability of the presence and appearance of necrotic tissue associated with the elastic collar compression device has not been directly studied, and its impact on acceptability is unknown.

5.3.2 Odour

Odour was reported in some studies on the elastic collar compression device (37, 45, 46). At times the client’s partner or friends noticed odour during the week that the device was in place, and health-care providers noticed it when removing the device.

5.3.3 Period of sexual abstinence

Healing takes one to two weeks longer following device placement than with surgical methods. Therefore, men who undergo MC with a device must be counselled to abstain from sex for a longer time than those who have a conventional surgical MC method, or a total of seven weeks on average. During the first week, while wearing the device, abstinence from all sexual activity is essential as the device may become displaced leading to potentially serious complications. Abstinence after the device is removed is essential until the wound is healed, which takes on average six more weeks but can be as long as 8-9 weeks in some men. If sex is resumed before then a condom is essential to protect the healing wound and prevent HIV transmission.

As an indication of the potential level of early resumption of sexual activity, a study in Zambia reported that 24% of men (n=221) in a routine surgical MC services setting acknowledged that their first post-operative sexual activity took place prior to six weeks after the surgical MC (48). Of those having sex, 46% had sex in the first three weeks; 82%

reported at least one unprotected sex act; and 37% reported sex with two or more partners. In another study, conducted in Kenya, overall 30.7% of men (n=1344) reported engaging in early sexual activity, usually three to four weeks after surgical MC (49). While data on men's resumption of sex after circumcision using a device were lacking, some men may find MC with a device unacceptable due to the slightly longer period of sexual abstinence.

5.3.4 Interference with work and daily activities

Several observational and comparative studies have reported on the effect of MC on clients' work and daily activities (28, 29, 40). The studies consistently report that circumcision using devices had interfered minimally with clients' work or daily activities except for sexual activity (as noted, men were instructed not to engage in sexual activity for six weeks after the procedure). Despite the consistency of findings, the overall quality of the evidence with respect to interference with daily activities was considered low due to indirectness and to the risk of bias, as neither patients nor observers was blinded.

Although both devices studied need to be worn for a week post-placement, their design is different. For this reason data regarding interference with activities of daily living were considered separately by type of device.

For the collar clamp type device, in a small pilot study, 28% of men (n=40) reported that the device disrupted sleep "somewhat" or "a lot", 5% reported that the device disrupted daily activities, and 10% reported that the device disrupted work "somewhat" or "a lot" (29). In this study 80% of men returned to work within two days after device placement. In another study clients (n=50) were asked to rate the interference of pain with resumption of normal activities using a visual analogue scale (0=no interference through 10=completely interferes) (28). The mean score for walking was 1; for sleeping, 2; for working, 1; and for "while enjoying life", 1.

For the elastic collar compression device, at two weeks post-procedure, greater interference with sleep and the ability to walk, work and drive a motorbike was reported in the conventional surgery group than in the device group, while somewhat greater interference with urination was reported in the elastic collar compression device group (40). At two weeks post-MC, a smaller percentage of men had taken time off from work in the device group than in the surgical group. Furthermore, among those who took time off from work after the procedure, men in the device group took less time off on average than men in the surgical group. Before they actually experienced the procedure, men in both the device and surgery groups perceived that circumcision would have a much larger impact on their daily activities, especially work-related activities, than what they actually experienced. In another comparative study, at seven days post-procedure, men in the device group reported that they had lost on average half a day (0.57 days) of work compared with more than a full day (1.15 days) in the surgery group (43).

Time taken off from work, school or other activities for the clinic visits for device placement and removal has not been compared with the time taken for clinic visits for conventional surgery. The time to return for device removal was not considered in the time off work calculation. Therefore, the total time taken off for the MC is not known, and a precise comparison cannot be made between device and surgical MC.

5.3.5 Mandatory second visit

When circumcision is performed using a device, men must return seven days later for safe device removal. Although a follow-up visit is usually advised after surgical MC, the sutures are absorbable and do not need to be removed; therefore, some clients do not return. Evidence is lacking whether the mandatory second visit with a device method may influence acceptability. Diverse return rates after surgical MC have been reported from Kenya and South Africa. In Kenya, during the 2009 Rapid Results Initiative campaign, 23% of men (n=36077) returned for a seventh-day follow-up visit. In a similar campaign in 2010, 41% returned (n=55376)(50). In a study on the roll-out of MC services in Orange Farm, South Africa, 67% of men (n=14011) returned for the second- through fourth-day visit. Of these an “unsatisfactory” proportion did so only after one or two telephone contacts from the service providers (51).

5.3.6 Values and preferences of health care providers

Overall, health-care providers, both physicians and non-physicians (primarily nurses and clinical officers) reported that performing circumcision using a device was easy (32, 39, 40, 42, 43). A significant proportion expressed a preference for a device over a surgical method. Most commonly, providers commented that the device techniques were:

- easier to perform and required less time
- provided better cosmetic results
- resulted in fewer complications
- eliminated the need for suturing
- caused less bleeding
- in the case of the elastic collar compression device, eliminated the need for routine injectable anaesthesia.

The quality of the evidence was considered to be moderate to high, based on the available data and expert opinion.

5.4 Resource use and costs

A systematic search of the literature identified three published studies on resource use and costs, and the authors shared one study in press. The studies were undertaken in Zambia (52), Uganda (53), Kenya (54) and Zimbabwe (55). One study compared the collar clamp device to surgical circumcision (52); the other studies evaluated costing aspects of the elastic collar compression device. Detailed summaries of the review of each study are included in Annex 2 (available on the WHO website). Findings are difficult to compare due to differences in research methods and study settings, including public or private ownership, staff mix and support structures and systems. The inclusion and exclusion of certain indirect costs (or the assumptions underpinning the cost calculation) also differ among the studies. Significant differences in the cost of the device also exist among the studies; one study excluded the cost of the device entirely. In comparing the costs of the device and the surgical methods, none of the studies considered the use of disposable or partly disposable kits in the surgical method although this is a common practice in many countries.

From the review of these four studies, the conclusion regarding use of devices suggests the potential to:

- reduce human resource costs by shifting the performance of MC procedures to lower cadres of health-care providers;
- reduce consumable costs other than the cost of the device;
- improve efficiency, particularly by increasing the output rate at a given level of staffing;
- improve the cost effectiveness of MC as an HIV prevention strategy by accelerating the pace at which MC targets are reached and HIV infections are averted.

However, there remain many uncertainties including whether there will be sufficient demand to realize potential efficiency gains, many costs are unknown including the cost of the device, and costs are highly contextual and will vary from country to country. These uncertainties warranted a conditional recommendation.

KEY PROGRAMMATIC CONSIDERATIONS

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6. KEY PROGRAMMATIC CONSIDERATIONS

6.1 Planning for successful scale-up

6.1.1 Device adoption and scale-up

Priority countries in East and Southern Africa were able to adopt medical MC as an additional HIV prevention strategy within a few years of the initial recommendation by WHO and UNAIDS. However, early adoption of MC as an innovation in HIV prevention was not necessarily followed by rapid scale-up of services⁶. Adoption of an innovation and its scale-up are two distinct processes, each of which should be planned (56). It may be useful for countries to consider the lessons already learnt from the adoption and scale-up of voluntary medical MC services as an HIV prevention intervention. The following factors have been identified as predicting a viable scale-up of national male circumcision programmes (57, 58):

- a national focal person, a national policy and operational/implementation strategy in place;
- a phased implementation approach, starting with pilot or demonstration sites that involve government and other key stakeholders;
- on-going government and community consultations accompanied by increasing country ownership;
- sustained high-level political support and the input of decision-makers to resolve implementation challenges as they arise.

Factors that have constrained the scale-up of national male circumcision programmes have been primarily related to the lack of readiness of the health system to absorb the innovation (see section 6.2) and the reluctance of the intended clientele—uncircumcised men ages 15–49—to use the services (13).

6.1.2 Phased implementation

Scaling up an innovation is an iterative process carried out over an extended period of time. National programmes should, therefore, plan to introduce prequalified MC devices in a phased manner (19). Phased implementation is also recommended for the following reasons:

- Evidence on the safety of devices is currently available only from use under well-resourced research conditions. Therefore, the frequency of adverse events when devices are used in more routine conditions must be monitored closely as services are scaled up.
- National programmes need to lead and coordinate with multiple organizations involved, whose support needs to be sustained throughout the scale-up. Policy- and decision-makers, providers and other stakeholders need to be engaged at all stages of implementation from approval and adoption to pilot demonstration and scale-up.
- Health systems need to be ready to adopt the new MC devices to ensure that provision is safe and that supply and demand are kept in balance.

⁶ “Scaling up” has been defined as deliberate efforts to increase the impact of health service innovations successfully tested in pilot or experimental projects so as to benefit more people and to foster policy and programme development on a lasting basis (MC and HIV prevention: operations research implications, (10)).

Pilot/demonstration projects

Pilot or demonstration projects are a first step in phased implementation. WHO encourages countries to undertake such projects to assess the feasibility of including MC devices in the minimum package of medical MC services. Implementing pilot projects is not only testing and demonstrating a model but also refining it through an on-going learning process. Pilot implementation projects should be:

- led by a country team;
- informed by participatory strategic assessments;
- informed by experience with other interventions in country and in other countries and settings;
- conducted under routine operating conditions with the types of providers, clients and settings that will be typical in programme implementation.

The perspectives, buy-in and endorsement of those who will be part of programme implementation and scale-up are critical to programme success. To enhance the likelihood that the pilot projects lead to successful scale-up, involving key stakeholders in the planning and implementation of pilot studies is recommended. Participatory approaches generate political commitment, build ownership and create champions, ensuring that issues are considered from multiple perspectives and that decisions are reached collectively about how to proceed in the specific local context. Participants could include policy-makers, programme managers, technical experts, service providers, community representatives and non-governmental organizations.

6.2 Health system readiness

The full range of financial, technical and human resources available in the context of research studies usually will not be available in pilot projects, which are conducted in routine services, or when innovations are taken to scale. Therefore, scaling-up the use of prequalified devices requires planning with a broad perspective of systems issues. Once developed, a strategic plan needs to be flexible and adjusted as scaling-up proceeds, as new factors emerge and circumstances change. Programme managers should identify funding for financial support beyond pilot projects.

A number of strategic decisions must be made, including decisions on the specific device that will be introduced, expectations for scale-up (e.g. geographic areas for initiation and expansion, target population to reach, level of service delivery sites); the pace of scale-up; the costs and the resources that need to be mobilized; and the information required to monitor and evaluate the process, its outcomes and impacts. While some policy and regulatory changes may be necessary, a prequalified device method will most likely be added into the existing minimum package of medical MC services, ensuring that the lessons learnt in pilot projects are applied. Since each prequalified MC device has a different mechanism of action, strategic decisions must be specific to each device. Subsequent sections address the following areas of programmatic considerations for enhancing the readiness of health systems:

- policies and regulations
- service delivery
- communication programming
- procurement, supply chain and waste management
- monitoring, reporting and evaluation
- resource requirements and cost considerations
- information gaps and needs.

6.3 Policies and regulations

Policies regarding the provision of conventional surgical male circumcision will already be in place in most priority countries. Policies and regulations that might affect the adoption of a prequalified device method for male circumcision should be reviewed to expedite progress while assuring safety. Such policies may include:

- pre-market approval and importation of medical devices
- licensing of manufacturers, wholesalers, importers and exporters
- post-market surveillance requirements
- cadres of health-care providers who are authorized in their scopes of practice to use devices to perform MC
- the level of the health-care system at which the MC devices may be used and under whose supervision
- medical ethics, including informed consent, confidentiality and the absence of coercion.

6.3.1 Pre-market approval, licensing and importation

Since male circumcision for HIV prevention is a public health intervention and involves large numbers of healthy men, a rigorous assessment of the clinical safety and efficacy of male circumcision devices is required. Governments may use the WHO Prequalification of Male Circumcision Devices Programme to inform decisions regarding pre-market approval, licensing and importation of adult male circumcision devices. WHO prequalification is based on a transparent and scientifically sound assessment process that helps to ensure that MC devices meet global standards of quality, safety and efficacy and that limited health-care resources are used optimally to improve health outcomes.

UN and other procurement agencies rely on WHO prequalification, in conjunction with other procurement criteria, to make their purchasing decisions. WHO advises governments to only approve the importation of and limit procurement to MC devices that WHO has prequalified.

In countries where studies on MC devices have taken place, regulatory approval for device use may have been granted for research purposes only. Programme managers need to ensure that the appropriate regulatory authority (usually the national regulatory authority responsible for medical devices) has approved use of the MC device in routine services.

MC devices should be authorized for use only in eligible populations in which the safety and efficacy of the device have been established by independent assessment such as the WHO TAG evaluations. As noted earlier, data were not available on the use among males under 18 years. Safety data on the use of MC devices on men living with HIV were also very limited. While men living with HIV will not themselves benefit from circumcision for the purpose of HIV prevention, if it is medically indicated, or they request circumcision after in-depth counselling on the known risks and benefits, conventional surgery may be offered. Until evidence is available on the safety and efficacy of the use of device circumcision for these populations, conventional surgical male circumcision methods remain the appropriate choice for these men.

The adoption of MC devices in the private sector might proceed rapidly and independently of public-sector decisions. Thus, limiting approval or registration of MC devices to devices that have been prequalified may help to ensure the quality and safety of MC devices used in the private sector.

6.3.2 Manufacturers' post-market surveillance

Manufacturers must demonstrate that they have a functioning system to collate information on incidents with their devices and to act on this information as necessary to ensure product safety. Manufacturers must keep records of all complaints concerning their products as per ISO 13485. They must evaluate complaints as they are received and must take corrective or preventive action as required. In addition, manufacturers, national programmes and providers should report to WHO when post-marketing surveillance detects any malfunctions or adverse events that lead or could have led to death or serious injury

WHO conducted a risk analysis of MC devices using the Failure Modes and Effects Analysis (FMEA) procedure which is one of the techniques specified in ISO 14971. Key risks and theoretical effects for each of the two devices are summarized in Tables 1 and 2 of the January 2013 TAG report (19). As devices are rolled out from study to field conditions and with broader use, additional device and adverse events can be expected to occur; these should be reported through post-market surveillance.

After satisfactory initial prequalification inspections, the WHO prequalification programme re-inspects manufacturing sites on a risk-based approach. If reassessment finds that a product and/or specified manufacturing site no longer complies with WHO requirements, such products and manufacturing sites will be removed from the list of prequalified male circumcision devices. Failure of a manufacturer to participate in the reassessment procedure also will lead to removal from the list of prequalified products.

In the following circumstances WHO may issue a notice of concern:

- in response to a complaint, findings of the WHO prequalification assessment, or poor performance in the field.
- after a site inspection that raises concern regarding compliance with specified standards such as ISO 13485:2003 on medical device – quality management systems (59).
- if WHO does not receive, on or before the due date agreed with the manufacturer, the response requested of the manufacturer to non-conformities noted in an inspection report, detailing the corrective actions taken or proposed to be taken.

Any active notices of concern will be posted on the WHO prequalification web site⁷. A notice of concern will remain active and posted on that web site until WHO judges the corrective actions acceptable.

Providers or managers experiencing any problems related to prequalified male circumcision devices should complete a "User complaint form for reporting problems and/or adverse events" and submit it to the following e-mail address: diagnostics@who.int.

Other considerations on post-market surveillance in national programme monitoring are addressed in section 6.7, Monitoring.

⁷ http://www.who.int/diagnostics_laboratory

6.3.3 Health-care providers authorized to use devices

Scopes of practice should be reviewed and revised as needed to allow appropriate cadres of health-care providers to perform MC using specific devices. Because the use of MC devices evaluated to date requires less sophisticated skills than conventional surgical methods, lower-level cadres of health-care providers may be able to perform MC safely using devices, thus potentially expanding their use to settings where there are few doctors or other surgically skilled personnel. Unnecessary restrictions on which cadres of providers are authorized to perform circumcisions using prequalified devices may hamper the availability of and equitable access to services and reduce the prevention impact. To ensure that the device methods are provided safely, initial pilot studies should assess which cadres can use the devices, and the findings should inform competency-based training.

6.4 Service delivery

Prequalified devices have been demonstrated to achieve circumcision safely when used by appropriately trained staff in suitably equipped settings and worn by clients according to instructions. Conventional surgical methods will still be needed, however, due to eligibility limits on device procedures, clients' preference, or the occasional need for surgical circumcision or intervention to manage adverse events. WHO advises that prequalified devices be used only in settings that can provide the necessary equipment and commodities, trained providers and backup surgical skills to manage adverse events within a timeframe appropriate to the specific device.

6.4.1 Physical facilities, equipment, pharmaceuticals and supplies

The requirements for facilities, equipment and commodities for device placement and removal will depend largely on the type of MC device that will be used. For collar clamp devices, in addition to the device itself, the facilities, equipment and commodities requirements are essentially the same as for conventional surgical male circumcision. While the method does not generally require sutures for haemostasis, it still requires a sterile field and instruments, injectable anaesthesia, and immediate, on-site surgical backup in the event that, once the foreskin is cut, the device slips, resulting in a loss of haemostasis and the need for intervention to prevent bleeding and suturing for closure.

In the studies on the elastic collar compression device, a sterile setting or instruments for placement were not required; clean examination gloves sufficed. Sterile instruments were required for removal, but the removal was a clean procedure and undertaken in the same types of facilities as placement. The device procedures do not require injectable anaesthetic or sutures. However, if the device displaces, is removed early during the week between placement and scheduled removal, or there is difficulty during removal of the foreskin, appropriate equipment for surgical intervention, including use of local injectable anaesthesia and suturing, may be needed.

Should surgical circumcision or surgical intervention be needed at any time following device application or removal, all sites should be ready to manage such events appropriately. For the collar clamp device, "immediate/on-site" surgical supplies will be necessary at the time of device placement. For the elastic collar compression device, during the week that men

have a device in situ, surgical resources must be available “within 6–12 hours timeframe” of a displacement or removal (19).

In general, the following types of commodities are required for the use of devices:

- multiple sizes of a specific device, to ensure proper fit and no delays in services (see section 6.6 on supply chain management);
- appropriate accessory equipment and supplies as per device;
- appropriate emergency equipment and commodities specifically for device methods that require injectable anaesthetic, in which case requirements are similar to those for conventional surgery;
- medications for pain management during and after device placement, during the week the device is worn, and at device removal, as per standard protocols appropriate to the device used.

6.4.2 Staff requirements and skills

In clinical safety and efficacy studies a team of two trained providers were required for placement: one serving as the ‘operator’, the other as the ‘assistant’. The number of providers necessary for device removal is less clear as it was not specified in most studies. Some studies allude to one, others to two. The number may depend on the device and the dexterity and experience of the provider. Until more data become available, it seems prudent for device removal to be assisted by a second provider, especially for the elastic collar compression device. The types of providers using the devices in the studies included physicians, clinical officers and nurses; all were deemed competent and placed and removed the device safely.

Compared to conventional surgical methods, circumcision using a device is simpler. Placement and removal of a device does not require routine suturing skills. Skills for working in a sterile field and injecting anaesthetic are required for the collar clamp device.

The use of devices does not obviate the need for surgical services. Skills for such services are still required for men who are under 18 years or otherwise not eligible for a device method, or for clients who prefer a surgical method.

Although the devices are designed to remain in place and not move with routine daily activities, there have been instances of device slippage (at the time of placement in the case of the collar clamp device) or displacement (in the case of the elastic collar compression device) or were removed by the client. Such events may require surgical intervention to prevent serious complications. While in study settings these events were rare, occurring in <0.5% of subjects, their frequency in routine health-care settings has not yet been determined.

Therefore, although the person performing the circumcision does not need surgical skills, an experienced, suitably qualified clinician must be available either at the same site or at a referral centre – dependent on the type of device. These clinicians should have specialized skills in dealing with retracted vessels (in the case of the collar clamp) or abnormal foreskin anatomy (in the case of the elastic ring compression) since the swelling and blistering can distort the penile anatomy.

Health-care providers must recognize the limits of their skills and know the steps to take if a complication occurs.

6.4.3 Accommodation of a second visit for device removal

When a device method is used, a second visit is required for device removal; services must be organized to accommodate both visits at an interval of one week. Although studies indicated that, for the collar clamp type device, spontaneous detachment would occur without significant consequences, men often wanted the device removed prior to spontaneous detachment because of the discomfort or pain associated with spontaneous detachment. Procedures for contacting clients who fail to come for scheduled removal appointments must be developed, such as sending reminder text messages to mobile phones (60).

6.4.4 Voluntary MMC is part of a comprehensive HIV prevention strategy

Medical MC does not provide complete protection against HIV. Therefore, it complements rather than replaces other HIV prevention strategies. The WHO-recommended minimum package for male circumcision includes:

- information about the risks and benefits of the MC procedure
- counselling about the need to adopt and maintain safer sexual practices
- access to HIV testing
- condom promotion and provision and
- management of sexually transmitted infections (STIs).

MC, whether performed surgically or using devices, should always be considered as part of a more comprehensive HIV prevention strategy. All sites providing MC services should ensure that clients receive all elements of the package.

6.4.5 Ensuring informed consent and the absence of coercion

Informed consent is the voluntary agreement of an individual to undergo circumcision, regardless of the method used. All site staff must be trained in the principle of informed consent and in the appropriate method to obtain it. Adult men seeking medical MC have the right to receive full information on the benefits and risks of circumcision and the specific method or MC device that will be used. Men should receive accurate information to help them decide whether a device method is the best option for them and to commit to the conditions of use. (See section 6.5, Communications programming.)

6.4.6 Client education and counselling

Because male circumcision using devices takes less time than conventional surgery, there is a theoretical concern that client education and counselling will suffer. There are multiple opportunities, however, for client education and counselling about medical MC include HIV counselling and testing (HCT) (individual or couple), before device placement, at the time of device placement, and at the second visit, for device removal. The return visit may be a second opportunity time for education and HIV-prevention counselling.

It will be important to determine if a man is a good candidate for device use, based on considerations such as travel during the week that he would wear the device and his availability return to the clinic for device removal. Men who do not prefer, or are not eligible for a device method, should be informed that they may be able eligible for conventional surgical MC.

Although specific instructions and educational messages will vary with each specific device, in general it will be important to:

- stress the importance of the device remaining in place for a week, the need to avoid activities that might displace the device including sexual intercourse and masturbation, and the necessity for prompt follow-up by a trained provider should a displacement occur;
- explain clearly the potential symptoms such as pain or odour that might be experienced while wearing the device and how to manage them;
- discourage self-removal of the device;
- explain clearly the need to return for a second visit in one week for device removal by a trained provider -- or earlier if there are concerns;
- underscore the need to abstain from sexual activity or always use a condom for an additional 6-7 weeks after device removal, until the wound is healed.

6.4.7 Clinical guidelines

Manufacturer's instructions for use are not a sufficient guide to competent performance with a device method. Device-specific clinical guidelines should be developed which include:

- device placement and removal;
- recognition and appropriate management, including referral, for complications and device events such as: self-removal; displacement in the case of the elastic compression device; slippage or premature detachment in the case of the collar compression device; wound dehiscence; or bleeding;
- at sites where conventional surgery is not offered, clear referral protocols (including contact numbers) for clients who want to be circumcised but are not eligible for the device;
- pain management protocols at all stages of device use;
- management of odour in the case of the elastic compression device.

6.4.8 Training

Use of prequalified MC devices may help to alleviate the human resource challenges by making the procedure easier and quicker and allowing for non-physician health cadres to perform MC procedure. Still, appropriate training is essential for all medical MC providers. The outcomes of device-assisted adult circumcisions performed by well-trained clinical officers or nurses were comparable to those of surgical MC performed by trained surgeons (32, 43). With appropriate training, lower-cadre nurses who had no experience with surgical adult male circumcision or the use of MC devices successfully performed device placements and removals (42). The use of MC devices may also reduce training time and help to optimize the use and time of health-care personnel.

All clinical staff expected to perform circumcisions using a device, including those with training and experience with surgical circumcision, will need to go through standardized device-specific competency-based training on device placement and removal. In addition, these service providers need to be competent in the skills required to provide the rest of the minimum package of services. The training course that enabled lower-cadre nurses to place and remove elastic collar compression devices safely and efficiently took three days (43).

The clinical training package does not need to teach surgical circumcision skills, because those placing devices do not need to be competent in surgical skills. However, they must be thoroughly educated about the risks of device slippage or displacement or self-removal, know the resultant signs and symptoms and how to manage those cases. They should know which speciality centre to contact, or which clinician in a pre-established network, so that the appropriate intervention can be undertaken within the recommended timeframe. The referral clinicians must be suitably qualified surgeons or medical providers who have received specific training to deal with swollen tissue and distorted penile anatomy.

Any additional training required—for example, in counselling or infection prevention—must be completed before training in the clinical skills needed for using MC devices. Several countries have developed specific, dedicated courses that provide more in-depth skills in counselling for MC. Counselling training should cover information and counselling specific to the device that the trainees will be using.

Key considerations for training include:

- When selecting staff to be trained, it is important that they begin performing MCs immediately after training. This ensures that they retain the skills acquired in training and that training resources are used efficiently.
- Clinical staff members who perform few circumcisions or who have rotated out of MC service delivery for an extended period may require refresher training.
- All training must include emergency management as appropriate for the device method used.
- Concepts of voluntarism and informed consent should be explained to all staff trained in the use of devices.

It is essential that MC programmes provide a system of supervision that supports trained health-care providers to perform MC with a device safely and ensure that they maintain competence.

6.4.9 Quality assurance

The existing 10 WHO standards for quality assurance of male circumcision services remain relevant but will need to be reviewed and revised as needed (61):

- An effective management system is established to oversee the provision of male circumcision services.
- The WHO minimum package of male circumcision services is provided.
- The facility has the necessary medicines, supplies, equipment and environment for providing safe male circumcision services of good quality.
- Providers are trained, qualified and competent.

- Clients are provided with information and education on HIV prevention and male circumcision.
- Assessments are performed to determine the condition of clients.
- Male circumcision is delivered according to evidence-based guidelines.
- Infection prevention and control measures are practised.
- Continuity of care is provided.
- A system for monitoring and evaluation is established (see section 6.7).

6.4.10 Appropriate modes of service delivery

In the priority countries in East and Southern Africa, medical MC services currently are delivered in a mix of modes. Primarily, three types of sites are operating: fixed, mobile and outreach sites (62). A further distinction is made between services provided routinely throughout the year and those provided temporarily during a specific time frame, often for one or several weeks, usually in the context of a campaign.

The choice of the most appropriate mix of service delivery modes will depend on whether the necessary requirements for device use can be met and on the local context. If device placement takes place in outreach sites, then an appropriate structure will need to be available for surgical intervention during the week between device placement and removal. Once an outreach team leaves a location after all clients have had devices removed, clients will need to know how to obtain follow-up care, should they need it.

Older, married men and men who are parents might be inhibited to undergo medical MC due to a lack for privacy – they do not want to stand in line with younger people (63). The use of MC devices may facilitate the development of service delivery sites that are “friendly” to adult men given that device use is currently limited to males over 18 years. For example, an MC method may be easier to implement in a non-clinical setting such as a workplace or village hall (53). Nonetheless, whenever a device is introduced into a new type of service delivery, an initial pilot project should be undertaken to assure that the necessary requirements for device use can be met, in particular the surgical backup facilities and skill.

6.5 Communication programming

Communications for device-specific messaging should be consistent with existing key messages regarding male circumcision (64).

6.5.1 Informing clients and their partners

Men seeking medical MC and their partners should receive accurate and complete information about the device method, including benefits and risks so that they can decide whether a device method is the best option for them.

- Benefits: minimal interference with activities of daily living (including work); quick procedure; most likely no need for sutures; minimal or no blood loss; good cosmetic result; with an elastic collar compression device, no need for an injectable anaesthetic.

- Risks: some pain while wearing and transient pain during device removal; while wearing the elastic collar compression device, possible odour and the risk of device displacement with erection or if the client engages in sexual activity (intercourse or masturbation); treatment for displacement may require surgery.

Men and their partners should commit to certain conditions of use, including:

- wearing the device for one week;
- abstaining from sexual activity (intercourse or masturbation) while wearing the device;
- abstaining from sexual activity or always using a condom for 6–7 weeks after device removal, until the wound is healed;
- not removing the device themselves but seeking a trained provider to do so;
- returning for a second visit after one week for device removal—or earlier if there are concerns.

Men who are not eligible for a device method should know that they may be able to be circumcised with conventional surgical methods. Women should encourage their partners to go for medical MC, whichever method is used.

Both partners should receive information about the appearance of wound healing by secondary intention and of necrotic tissue in the case of the elastic collar compression device.

6.5.2 Issues for policy- and decision-makers

Policy- and decision-makers may have questions about adopting MC devices for use in national programmes. Communications can build on the potential benefits that MC devices bring to HIV prevention programmes, such as to improve:

- efficiency (simpler, faster, larger number of health workers to perform medical MC);
- accessibility to safe MC services (more easily deployed in rural, mobile or outreach settings provided that appropriate surgical backup is in place);
- acceptability and uptake of safe MC (bloodless, sutureless and, if the elastic collar compression device is used, no need for injectable anaesthetic).

Communications will also need to address issues such as:

- the costs of using MC devices, which have not yet been fully quantified;
- the need to provide distinct service delivery approaches for clients who are not eligible for a device method, including age ineligibility;
- the restriction of MC device use to settings that can ensure device-appropriate surgical backup, either immediately on-site or within the advised timeframe;
- the effect on demand of offering MC with a device, which is not yet known.

6.5.3 Engaging providers and programme managers

As key stakeholders, providers and programme managers should be involved in the pilot demonstration projects. Once a country has decided to include MC devices in their national male circumcision programme, programme managers and providers are the key implementers of that decision. They are the ones who must actually alter the way they work. Messages need to clearly convey advantages and disadvantages related to adopting MC devices. The greater the perceived advantage, the more rapid will be the adoption. Five perceived characteristics of an innovation, influence people's perceptions of it (65) as listed below along with an example from the device perspective.

- **Relative advantage:** Devices offer benefits to health-care providers and potentially to some of the people they serve.
- **Compatibility:** Introducing a device method is consistent with accepted organizational values to expand coverage.
- **Simplicity:** Use of devices for MC is easy to understand including training.
- **Trialability:** Devices can be introduced without seriously disrupting current services.
- **Observability:** The results of introducing devices can be measured to show progress.

In communities where MC devices are introduced, a variety of types of health-care workers in both public and private settings need to receive clear communications about device introduction and use.

Provider audiences most likely will include:

- community extension workers who provide counselling and information on medical MC in home and community arenas;
- health-care workers, including site managers, providers and counsellors;
- HIV counselling and testing providers, whether community-based, facility-based or mobile;
- private sector providers.

Even providers who have not been trained on device use should know what a device looks like and understand the mechanism of action, secondary intention healing and possible AEs and their management. If a client arrives at a health facility wearing a device or presents with a wound healing by secondary intention, providers need to be able to provide appropriate care or referral to appropriately skilled surgical providers.

Other key messages to providers include:

- Only trained providers should place and remove MC devices.
- Only WHO-prequalified MC devices should be used (devices that have undergone rigorous evaluation).
- MC devices should be used only with men who meet the evidence-based eligibility criteria.



6.5.4 Raising community awareness and demand creation

Prequalified MC devices may generate more demand for MC services by offering a method that may improve client acceptability (66-68). In addition to providing accurate and complete information about devices, it is equally important to address misconceptions as they arise. The media is an important source of information; briefings for journalists about device methods are valuable to help ensure that they provide correct information to the public. It is important for the community to know that MC services are voluntary, high quality and safe, and that providers have been trained to use the devices. Adverse events and misinformation have the potential to discourage service uptake. This further underscores the importance of a phased approach to implementation to assure quality, starting with pilot studies and demonstration sites, appropriate training and supervision of providers, and effective instructions to patients.

6.6 Procurement, supply chain and waste management

Any programme offering MC with devices needs a reliable procurement and supply management system to ensure consistent supply of essential commodities. When one or more devices and related supplies are added to the minimum package of medical MC services, programme planners and policy-makers must assess and plan for the costs, logistics, commodities and waste management requirements of the new mix of services. A dynamic procurement and supply management (PSM) system relies on information from service sites; the MOH, donors and implementing agencies will need to coordinate to support a good system. It will be critical to assure that the MC for HIV prevention programme is neither under-resourced—with resultant stock-outs and stall in the number of MC procedures performed—or over-resourced—with a resultant waste of valuable commodities that expire in the warehouse.

Since the roll-out of medical MC services with devices is untested, assessing the current PSM system will be an important initial step in preparation for the introduction of devices. This assessment should note the components, stakeholders and flow of information and commodities in the current system, or systems, of PSM.

Forecasting programmatic needs, even in the midst of uncertainty, is an essential step in providing quality services. Continual monitoring of consumption at the site level is critical to accurately projecting need and placing orders in a timely fashion. Some particular procurement, supply and logistic considerations and challenges related to device use include:

- Devices are available in multiple sizes. A sufficient quantity of each size must be stocked at each service delivery site. To inform decisions on the quantity to order, small studies of penile size should be conducted at select sites currently providing medical MC services (69). It can be anticipated that size needs will vary across and within countries. As device use expands, monitoring of the device sizes used will further inform procurement.
- A device usually includes several unique components for placement, for example, an inner ring, outer ring and measuring tools; and possibly unique components for removal. The required components may be supplied individually, in a kit or a combination thereof. It will be important to decide how to obtain all the necessary components. Procurement decisions should recognize that, on average, more than one device will be required per

patient; for example, if a package of the wrong device size is opened, or a component of the device drops to the floor, then another must be opened to replace that piece.

- Accessories and other supplies may be required for the correct placement and removal of devices but these accessories are often not provided by the device manufacturer and must be procured separately. These items should be listed and procured in sufficient quantity to accommodate the expected rate of device use. Logistics planning will also be affected by whether accessories may be reused, must be sterilized or disinfected or should be discarded after a single use.
- The number of circumcisions that can be performed concurrently should be considered, as some of the instruments and supplies (e.g. ring cutter, marking pen) may be stocked per procedure room and reused over a period of time.
- As placement and removal occur at two different times, supply management will need to assure that the quantities of commodities required for removal are commensurate with the quantities of commodities required for placement.
- Adequate and appropriate supplies and equipment need to be available in case of an adverse event. The procurement of such commodities should be determined by the timing of potential adverse events, the management protocol for a specific type of event, and the referral protocol at a particular type of service delivery site.
- Forecasting needs to consider the shelf life of the product.

The proportion of men who will require, or prefer, conventional surgery will need to be considered, and resources for surgeries, if done on site, also will need to be estimated.

All procurements require sufficient lead times. A standard list of commodities for surgical MC programmes implies management of over 50 consumable products, including commodities for waste management, HIV counselling and testing, and STI treatment. Including MC devices in the minimum package would alter this list. Lastly, the storage conditions for a specific device type (e.g. exposure to light and humidity, package dimensions) must also be considered and appropriate space made available throughout the supply chain.

With the further complexity of adding MC devices, the supply chain and logistics systems need to evolve from moving commodities quickly through the system with minimal handling to a more sophisticated system that includes warehouse management, distribution, oversight of consumption and waste disposal practices at the service delivery site, forecasting of needs, and the reverse logistics of programme-generated waste. Programme planners need to consider the additional resources and costs associated with a more complex MC supply chain, including staffing, warehousing and distribution of supplies.

Bulk procurement also will need consideration. The desire to save money by pooling small orders into a much larger one may need to be tempered by the uncertainty of demand for MC devices in the country, at least initially, and the shelf life of the devices and accessories. Partnerships in countries and within a region may be an efficient mechanism to ensure adequate production and distribution capacity as well as a reasonable price for a public health commodity.

In general, waste management would follow the same protocols as for surgical MC. If metal instruments are reusable, they must be properly disinfected or sterilized. Device components should be considered biological waste. The disposal by incineration or burying should follow either the manufacturer's instructions or those of the national programme.

6.7 Monitoring, reporting and evaluation

The introduction of a new method of male circumcision using an in situ device implies additional monitoring, reporting and evaluation activities to inform decision-making. National programmes will need to plan for and dedicate resources to these activities. The additional resources required, however, should be modest if a country already has a routine programme monitoring, reporting and evaluation system for MC services and an established quality assurance system.

Public health tasks include: post-marketing vigilance; active surveillance during initial introduction; incorporation into on-going monitoring, reporting and quality assurance systems; and evaluation. Safety evaluations to date have been based on data from research settings. As devices are introduced, further emphasis should be placed on safety. Early monitoring in routine service settings will provide more information on safety and use in diverse service delivery settings before expanding to larger-scale use. Pilot studies and projects provide the opportunity to test safety monitoring strategies and to build a local cadre with expertise to assist with wider implementation. In the medium and longer terms, on-going safety and programme monitoring will be needed as will evaluation of quality, programme effectiveness and efficiency. Revisions and refinements in monitoring can be anticipated as experience with device use grows.

6.7.1 Programmatic post-market surveillance

As noted (section 6.3.2), manufacturers must have a functioning system to collate information on problems and complications with their devices and to act on this information as necessary to ensure product safety. While the obligation to report adverse events and malfunctions associated with use of medical devices may differ between countries, national programmes generally will need to develop a link with the manufacturer for reporting incidents (70).

The main responsibility of recording and reporting adverse events will lie with national programmes. There needs to be a mechanism for monitoring safety and performance of male circumcision devices and ensuring that information about any adverse events or device-related incidents flows back to the manufacturer or distributor.

The post-market surveillance reporting process starts with problem identification by the patient using the device or his health-care provider. Therefore, both must be alert to the importance of reporting device-related issues and adverse events. The chain of reporting should be clear, as should be the type of events to report and the reporting timeframe. Programmes can work collaboratively with providers to ensure that providers promptly and accurately report incidents with devices, both user- or device-related. Full reporting will allow documentation and analysis of the incidents and inform and stimulate appropriate corrective action.

WHO's role related to complaints and product alerts

Programmes experiencing any problems related to prequalified male circumcision devices should complete a "User complaint form for reporting problems and/or adverse events" and submit it to the following e-mail address: diagnostics@who.int.

As safe use of medical devices is an international concern, the contributions of each national programme are crucial to the quality of the overall system.

6.7.2 Routine surveillance of safety with use

Unlike the experience to date with surgical circumcision in programmes, in which over two million procedures have been performed outside research settings, available data on use of devices is restricted to several thousand men in the context of clinical research. Thus, it is important to ensure careful surveillance for adverse events as the device is introduced into programmes and use expands (71). This surveillance will help to assess the incidence of rare serious events.

Active surveillance should be conducted as devices are introduced in non-research settings. Active surveillance means a proactive effort is made to follow up men who do not return and determine if they have experienced any adverse event, anticipated or unanticipated. The WHO TAG recommended active follow-up of the first 1000 clients when a new device is introduced into a programme. This active follow-up should take place in the context of routine service delivery and not as an aspect of other studies such as the pilot implementation studies. The purpose is to capture, among these 1000 clients, all device incidents, complications and adverse events and to assess that their incidence is within acceptable limits.

Once the rate of adverse events with the device is deemed low by an independent group, active surveillance can be changed to passive monitoring (including post-marketing vigilance). This phased approach will also permit programmes to review their safety monitoring system, including reporting forms, and revise as needed so that information is collected on an on-going, systematic basis.

Several types of adverse events unique to device use, as well as device incidents, will need to be incorporated into routine recording and reporting forms. Specific device incidents, adverse events, definitions and recording of adverse events should be, as much as possible, standardized to facilitate compilation, comparison and analysis across different settings. Examples of device incidents include device malfunctions or failures, potential contamination of a sterile package, problems with packaging and failure to adhere to the instructions for use.

A system for classifying the severity of an adverse event needs to be instituted. Complications, even mild ones, may have implications for costs, service delivery and information for men and for providers. An independent advisory group dedicated to analysing and classifying events should review all reports of complications or adverse events. The group should render recommendations for programme actions and improvement as well as reporting to the manufacturer and to WHO as part of post marketing surveillance, as described earlier.



6.7.3 Programme monitoring

Particularly useful information that can be collected through on-going monitoring of service delivery includes: numbers of each method of male circumcision (specific surgical or device method); days and hours that the facility is open for MC services, client's age, type of provider, type of service delivery setting (fixed, mobile or outreach) and distance of client's residence from site. Disaggregation of the total number of MCs performed by some of these categories will help to assess outcomes and guide services and programmes. Rates of adverse events can be compared by method of MC used (surgical or by device type).

The introductory phase should provide useful information for programmes on the proportion of men who accept device use and their eligibility and on rates of return to the second visit and for further characterizing device events such as displacements, self-removals and adverse events. The management and outcomes of men with a device-related or adverse event also should be recorded.

Monitoring the rate of return for the one-week device removal visit is important since safe completion of MC requires device removal by a trained provider. The extent and reasons for not returning and best practices for active follow-up can be evaluated. Distance from clinics, opportunity costs of travel time and missing work may contribute to missing the second visit. These and other reasons can be assessed, as can the cost-effectiveness of seeking out those who do not return.

6.7.4 Data and information flows

A written monitoring plan for a national programme should clearly indicate the flow of monitoring data. Monitoring data should follow as much as possible the usual reporting processes. Data collection from service sites and analysis may take place at the sub-regional or regional levels, as well as at the national level by staff dedicated to safety monitoring. Data to inform monitoring and evaluation may come from multiple sources, including clinic records and report forms, surveillance (active and passive) for AEs, and specific studies.

Data collected at central levels should be analysed and the findings transformed into information that should flow back to the individual sites, helping to address problems and improve quality. For programme and facility managers, knowledge of the incidence of adverse events and programme quality is important when communicating with the public and the news media about the programme and putting in context individual instances of complications or adverse events that the media may report. If not adequately addressed, such reports could undermine public confidence in the male circumcision programme and thus prevent the programme from reaching its public health objectives.

Once available in a country, devices may be used outside the formal health sector by providers who have not received adequate training. Device incidents and adverse events occurring with such use should be included in the monitoring system, but these events can be difficult to capture.

6.7.5 Evaluation

Effectiveness and efficiency

Male circumcision for HIV prevention with use of devices may increase programme effectiveness and efficiency through reduced time required for procedures and thus greater client throughput (volumes), reduced cost per procedure, an easier procedure that allows task shifting, and improved acceptability, leading to increased uptake. However, only with research on routine services can these advantages be clearly determined and quantified.

Operational and special research

A number of operational research topics have been identified as important. These include optimal management of pain associated with a specific device, odour management (in the case of the elastic collar compression type of device), and effective and efficient service delivery models and service configurations, including surgical backup services that suit the specific type of device. Analysis of the costs of different methods of MC in routine service delivery will help to determine the most efficient use of resources.

6.8 Resource requirements and cost considerations

While the resources and cost of introducing MC devices into a national programme will be an important consideration in the decision-making, it should not be the only criterion. A device method may help a country meet catch-up phase targets more quickly, which may ultimately prove more cost-effective than taking longer to reach the same goal. The net savings due to HIV infections averted could be realized sooner, along with further reductions in the incidence of HIV.

Utilization of site capacity has an impact on the unit cost of circumcision by any method. Achieving higher efficiencies with MC devices assumes that there is sufficient demand to meet a specific service provision capacity. If few clients come during the facility hours dedicated to MC services, the efficiency advantages of using the device may be eroded, i.e. the staff and other fixed costs for surgical and device circumcisions will be the same regardless of the number of procedures performed. This highlights the importance of demand creation and a balance between service supply and demand. It also underlines the importance of setting and costing realistic targets during scale-up for both device and surgical MC and adjusting these targets as needed over the planning period based on incoming implementation data.

Finally, costs are highly contextual and will vary from country to country. Cost estimates and resource requirements should be developed for each programme based on country-specific parameters. These may include the policy framework, the ability to task-shift circumcisions with devices to a lower-level cadre of staff, demographic and logistical characteristics of geographic regions and the feasibility of scaling up circumcision services more rapidly with devices.

6.8.1 Key cost drivers

The two key contributors to unit cost are staff and consumables. The mode of delivery and the selected service delivery channel can also have an impact on human resource requirements and associated costs. Device MC allows for lower-level cadres of staff to be involved, which can have considerable impact on total staff costs. Device MC also has the potential for more efficient use of staff time in a multi-bed setting.

There are also a number of factors that may contribute to poor efficiency—particularly the match between anticipated demand and service provision capacity. As described above, if dedicated circumcision teams are employed in dedicated MC sites, a low throughput of clients will result in inefficiencies and higher unit costs for human resource requirements.

The cost of the device is the single largest contributor to the consumables cost of device circumcisions. Therefore, efficient procurement of the devices should receive significant attention. As the use of devices expands and the total volume of devices procured increases, it is likely that the cost per device will fall. Countries may also want to consider the costs and benefits in certain settings associated with preparing a kit of consumables. A thorough cost-benefit analysis should be carried out before deciding to prepare such kits.

6.8.2 Other resource and cost considerations

Post-market safety monitoring, active surveillance and programme monitoring

When MC devices are first introduced, initial investments will need to be made to set up a post-market monitoring system (see section 6.7). The introduction of devices is, however, unlikely to have a significant impact on the cost of routine data analysis and reporting at regional and national levels in an existing MC programme.

Procurement and supply chain management

The introduction of MC devices will require assessment and adaptation of the existing procurement and supply chain management system or require a new system. The need to deliver and maintain several device sizes and the additional storage required at all levels of the system will likely add to costs.

Demand creation

Raising community awareness and creating demand to match the capacity of established MC services in any particular location is critical. The benefits of the device MC method provide an opportunity to generate demand for MC. Countries should plan to invest adequately in community awareness and demand creation activities. Planners should anticipate the costs associated with the redevelopment of MC communication content for all media and additional production cost for amended and new materials. There are costs involved, also, in raising awareness about MC devices amongst key stakeholders, including politicians, policy-makers, journalists and providers.

Staff training and supervision

Training can account for a significant cost not only at the start of the programme but also on an on-going basis due to staff turnover and loss of staff members to other services. Planners should also provide for building the capacity of managers and supervisors.

Surgical referrals

A referral system will need to be set up to ensure timely surgery for clients who are not eligible for device circumcision and when reversion to a surgical circumcision or other surgical intervention is necessary. Establishing or expanding a referral system may require investment in system design, development of guidelines and capacity building for staff. Capacity building in referral should be incorporated into MC training so as to avoid the need for a second round of training.

Physical infrastructure

In most settings device circumcisions, particularly with the elastic collar compression device, are less demanding on infrastructure than surgical circumcision. Therefore, there is less cost and effort in preparing space for such services. However, with the current requirement for surgical backup, cost implications of providing infrastructure for this would also need to be considered, particularly if services will be offered in locations where surgical circumcision has not been provided.

6.9 Information gaps and needs

The ministries of health in priority countries in East and Southern Africa are undertaking pilot demonstration studies on the use of adult MC devices for HIV prevention, with support from international partners such as the US President's Emergency Program for AIDS Relief (PEPFAR) and the Bill and Melinda Gates Foundation. Data from these pilot studies as well as from post-market surveillance and other research efforts will further clarify the safety, acceptability, feasibility and costs of using adult MC devices in routine health care settings. In particular, the frequency of AEs in non-study settings needs to be quantified, and the causes of device displacements and self-removals can be better understood and mitigated.

Population-based studies will help to understand better and to address potential barriers to the acceptability of MC using a device method, such as wearing the device for a week, the required second visit, an additional week of sexual abstinence (compared with surgical MC), pain, and odour while the devices are in situ. More research is required to identify and standardize the best protocol for managing pain at placement, at removal and the week in between. The problem of odour needs to be further investigated to determine how best it can be prevented or how it can be effectively managed. Also needed are studies to determine good messaging regarding device use, sexual abstinence and condom use during healing.

Bridging studies are required to establish the efficacy and safety of MC devices in men under age 18. In addition, since there were limited data on the safety of using MC devices in HIV-infected men, it is important to monitor their safety in this population.

The risk of HIV transmission during wound healing should be assessed through modelling studies in order to better understand risk–benefit considerations. This information will inform the development of the most appropriate and effective client education and counselling interventions at service sites.

Since full healing, maturation and remodelling of scarring may take up to one year after MC, cosmetic and functional outcomes at one year post-MC with a device should be compared with the results with surgical methods.

The use of a device method in an MC programme is likely to result in a “mixed” method service delivery model rather than a single-method model. As countries continue to scale up, it will be important to assess the incremental cost of introducing device circumcisions into existing programmes taking into account different service delivery settings.

Finally, it will be important to study the effect (upward or downward) of introducing MC devices on the demand for medical MC services since demand contributes to the variance in costs.



REFERENCES

1. Auvert B et al. Randomized, controlled intervention trial of male circumcision for reduction of HIV infection risk: the ANRS 1265 Trial. *PLoS Med*, 2005, 2(11):e298.
2. Bailey R et al. Male circumcision for HIV prevention in young men in Kisumu, Kenya: a randomised controlled trial. *Lancet*, 2007, 369:643 - 656.
3. Gray R et al. Male circumcision for HIV prevention in men in Rakai, Uganda: a randomised trial. *Lancet*, 2007, 369:657 - 666.
4. WHO/UNAIDS. *New data on Male Circumcision and HIV Prevention: Policy and Programme Implications. WHO/UNAIDS Technical Consultation on Male Circumcision and HIV Prevention: Research Implications for Policy and Programming. Conclusions and Recommendations*. Montreux, World Health Organization, 2007. http://www.who.int/hiv/mediacentre/MCrecommendations_en.pdf.
5. WHO/UNAIDS. *Joint strategic action framework to accelerate the scale up of voluntary medical male circumcision for HIV prevention in Eastern and Southern Africa*. Geneva, Switzerland, Joint United Nations Programme on HIV/AIDS, 2011. http://www.unaids.org/en/media/unaids/contentassets/documents/unaidspublication/2011/JC2251_Action_Framework_circumcision_en.pdf.
6. Mehta SC et al. The long term efficacy of medical male circumcision against HIV acquisition. *AIDS*. 2013, doi: 10.1097/01.aids.0000432444.30308.2d.
7. Gray R et al. The effectiveness of male circumcision for HIV prevention and effects on risk behaviors in a posttrial follow-up study. *AIDS*, 2012, 26(5):609-615 610.1097/QAD.1090b1013e3283504a3283503f.
8. Auvert B, et al. Association of the ANRS-12126 male circumcision project with HIV levels among men in a South African township: Evaluation of effectiveness using cross-sectional surveys. *PLoS Med*, 2013, 10(9):e1001509.
9. Njeuhmeli E et al. Voluntary Medical Male Circumcision: Modeling the Impact and Cost of Expanding Male Circumcision for HIV Prevention in Eastern and Southern Africa. *PLoS Med*, 2011, 8(11):e1001132.
10. WHO. *Progress in the scale-up of voluntary medical MC*. unpublished report, World Health Organization, 2013.
11. Auvert B et al. Estimating the Resources Needed and Savings Anticipated from Roll-Out of Adult Male Circumcision in Sub-Saharan Africa. *PLoS ONE*, 2008, 3(8):e2679.
12. Curran K et al. Voluntary Medical Male Circumcision: Strategies for Meeting the Human Resource Needs of Scale-Up in Southern and Eastern Africa. *PLoS Med*, 2011, 8(11):e1001129.
13. WHO. *Progress in scaling up voluntary male circumcision for HIV prevention in East and Southern Africa: January-December 2011*. Geneva, Switzerland, World Health Organization, 2012. http://www.malecircumcision.org/country_updates/documents/FINAL_VMMC_Progress_Report_Jan-Dec_2011_WHO.pdf.
14. Herman-Roloff A et al. Implementing Voluntary Medical Male Circumcision for HIV Prevention in Nyanza Province, Kenya: Lessons Learned during the First Year. *PLoS ONE*, 2011, 6(4):e18299.
15. Reed JB et al. Voluntary Medical Male Circumcision: An HIV Prevention Priority for PEPFAR. *Journal of Acquired Immune Deficiency Syndromes*, 2012, 60:S88-S95 10.1097/QAI.1090b1013e31825cac31824e.
16. Mahler HR et al. Voluntary medical male circumcision: matching demand and supply with quality and efficiency in a high volume campaign in Iringa Region, Tanzania. *PLoS Medicine*, 2011, 11:e1001131.
17. Perchal P, Odingo G, Pavin M. *Exploring the human resources for health landscape for adult male circumcision rollout in four districts in Nyanza Province, Kenya*. New York, EngenderHealth, 2011. <http://www.engenderhealth.org/files/pubs/hiv-aids-stis/engenderhealth-mc-hrtna-report-final.pdf>.
18. WHO/UNAIDS/Jhpiego. *Considerations for implementing models for optimizing the volume and efficiency of male circumcision services*. Geneva, Switzerland, The World Health Organization, 2010. http://www.malecircumcision.org/programs/documents/mc_MOVE_2010_web.pdf.

19. WHO. *WHO Technical Advisory Group on Innovations in Male Circumcision: Evaluation of two adult devices*. Geneva, Switzerland, World Health Organization, 2013. http://apps.who.int/iris/bitstream/10665/85269/1/9789241505635_eng.pdf.
20. WHO. *WHO Handbook for Guideline Development*. Geneva, Switzerland, World Health Organization, 2012.
21. Siegfried N et al. Male circumcision for prevention of heterosexual acquisition of HIV in men. *Cochrane Database System Review*, 2009, (2):CD003362.
22. Global Harmonization Task Force Study Group 5. Reportable Events During Pre-Market Clinical Investigations 2012.
23. Cheng Y. A recommendable standard protocol of adult male circumcision with the Chinese Shang Ring: outcomes of 328 cases in China. *National Journal of Andrology*, 2009, 15(7):584-592.
24. Li H-N. Shang Ring circumcision versus conventional surgical procedures: comparison of clinical effectiveness. *National Journal of Andrology*, 2010, 16(4):325-327.
25. Peng YF et al. Clinical application of a new device for minimally invasive circumcision. *Asian Journal of Andrology*, 2008, 10(3):447-454.
26. Peng YF et al. Standardized male circumcision with Shang Ring reduces postoperative complications: a report of 351 cases. *National Journal of Andrology*, 2010, 16(11):963-966.
27. Yan B et al. Circumcision with the Chinese Shang Ring in children: outcomes of 824 cases. *National Journal of Andrology*, 2010, 16(3):250-253.
28. Barone MA et al. Randomized trial of the Shang Ring for adult male circumcision with removal at one to three weeks: Delayed removal leads to detachment. *Journal of Acquired Immune Deficiency Syndrome*, 2012, 60(3):e82-e89.
29. Barone MA et al. The Shang Ring device for adult male circumcision: A proof of concept study in Kenya. *Journal of Acquired Immune Deficiency Syndrome*, 2011, 57:e7-e12.
30. Kigozi G et al. The acceptability and safety of the Shang Ring for adult male circumcision in Rakai, Uganda. *Journal of Acquired Immune Deficiency Syndrome*, 2013, [Epub ahead of print].
31. Sokal DC et al. Randomized controlled trial of a minimally invasive circumcision device, the Shang Ring, versus conventional surgical techniques for adult male circumcision: safety and acceptability. *Submitted for publication*, 2013.
32. Sokal DC et al. *A Field Study of Male Circumcision Using a Minimally-Invasive Device, the Shang Ring, in Routine Clinical Settings in Kenya & Zambia. [Report to The Technical Advisory Group on Innovations in Male Circumcision, World Health Organization]*. Durham, NC, USA, FHI 360, 2012 October 29.
33. FHI360. *The Shang Ring: Evaluation of Healing Time at Three Time Intervals and Potential for Spontaneous Detachment [Confidential Statistical Report and Table, Study #10214]*. Durham, NC, USA, FHI 360, 2011 April 27.
34. Sokal DC et al., editors. *Randomized controlled trial of the Shang Ring versus conventional surgical techniques for adult male circumcision in Kenya and Zambia (TUAC0404)* XIX International AIDS Conference 2012 22-27 July Washington, DC, USA.
35. FHI360. *Comparison of the Shang Ring with Conventional Surgical Methods: A Randomized Controlled Trial (RCT10220) [Confidential Statistical Report and Tables]*. Durham, NC, USA, FHI 360, 2012 July.
36. FHI360. *A Prospective Observational Study of Male Circumcision Using the Shang Ring in Routine Clinical Settings in Kenya & Zambia [Confidential Statistical Report and Tables, Study #10278]*. Durham, NC, USA, 2012 October 25.
37. Bitega JP et al. Safety and efficacy of the PrePex device for rapid scale-up of male circumcision for HIV prevention in resource-limited settings. *Journal of Acquired Immune Deficiency Syndrome*, 2011, 58(5):e127-e134.
38. Mutabazi V et al. One-Arm, Open-Label, Prospective, Cohort Field Study to Assess the Safety and Efficacy of the PrePex Device for Scale-Up of Nonsurgical Circumcision When Performed by Nurses in Resource-Limited Settings for HIV Prevention. *Journal of Acquired Immune Deficiency Syndromes*, 2013, 63(3):315-322 10.1097/QAI.1090b1013e31828e36412.

39. Mutabazi V et al. *One Arm, Open Label, Prospective, Cohort Field Study to Assess the Safety and Efficacy of the PrePex™ Device for Scale Up of Non-Surgical Circumcision when Performed by Nurses in Resource Limited Settings for HIV Prevention (Protocol RMC-03)*. 2012 January 10.
40. Tshimanga M et al. *A Randomized Controlled Trial Comparing the PrePex™ Device to Forceps Guided Surgical Circumcision for Rapid Scale-Up of Male Circumcision in Zimbabwe. Phase II: Randomized Trial Report*. Harare, Zimbabwe, Ministry of Health and Child Welfare, 2013 January.
41. Tshimanga M et al. *Evaluation of Safety and Efficacy of PrePex™ Device for Male Circumcision in Zimbabwe. Phase I: Device Safety Trial Report*. Harare, Zimbabwe, Ministry of Health and Child Welfare, 2013 January.
42. Tshimanga M et al. *Evaluation of Safety and Efficacy of PrePex™ Device for Male Circumcision in Zimbabwe. Phase 3: Cohort field study on safety and efficacy of the PrePex circumcision device when performed by nurses*. Harare, Zimbabwe, Ministry of Health and Child Welfare, 2013 January.
43. Mutabazi V et al. HIV prevention: male circumcision comparison between a non-surgical device to a surgical technique in resource-limited settings: a prospective, randomized, non-masked trial. *Journal of Acquired Immune Deficiency Syndrome*, 2012, 61(1):49-55.
44. Mutabazi V et al. One arm, open label, prospective, cohort field study to assess the safety and efficacy of the PrePex device for scale-up of non-surgical circumcision when performed by nurses in resource-limited settings for HIV prevention (TUAC0405). *XIX International AIDS Conferenc*. 2012.
45. Galukande M et al. *Interim Report. HIV Prevention: Safety Study of a Non-Surgical Device for Adult Male Circumcision with No Injected Anesthesia in a Non Sterile Setting, January 2013*. Kampala, Uganda, Confidential report for International Medical Group (IMG), 2013 January 16.
46. Kigozi G. *Acceptability and Safety of the PrePex Device for Male Circumcision: Rakai (U01 AI075115-0451)*. Kalisizo, Rakai, Uganda, Rakai Health Sciences Program (RHSP), 2013 January 22.
47. Hallett T et al. Will circumcision provide even more protection from HIV to women and men? New estimates of the population impact of circumcision interventions. *Sexually Transmitted Infection*, 2011, 87:88-93.
48. Hewett PC et al. Sex with stitches: assessing the resumption of sexual activity during the postcircumcision wound-healing period. *AIDS*, 2012, 26(6):749-756 710.1097/QAD.1090b1013e32835097ff.
49. Herman-Roloff A, Bailey R, Agot K. Factors Associated with the Early Resumption of Sexual Activity Following Medical Male Circumcision in Nyanza Province, Kenya. *AIDS and Behavior*, 2012, 16(5):1173-1181.
50. Government of Kenya. *Progress report on Kenya's Voluntary Medical Male Circumcision Programme, 2008-2010*. Nairobi, Kenya, Ministry of Public Health and Sanitation, 2012.
51. Lissouba P et al. A model for the roll-out of comprehensive adult male circumcision services in African low-income settings of high HIV incidence: the ANRS 12126 Bophelo Pele project. *PLoS Med*, 2010, 7:e1000309.
52. Bratt JH, Zyambo Z. Comparing direct costs of facility-based Shang Ring provision versus a standard surgical technique for voluntary medical male circumcision in Zambia. *Journal of Acquired Immune Deficiency Syndromes*, 2013, Publish Ahead of Print:10.1097/QAI.1090b1013e31828e39526.
53. Duffy K et al. Reach and Cost-Effectiveness of the PrePex Device for Safe Male Circumcision in Uganda. *PLoS ONE*, 2013, 8(5):e63134.
54. Obiero W, Young MR, Bailey RC. The PrePex Device Is Unlikely to Achieve Cost-Savings Compared to the Forceps-Guided Method in Male Circumcision Programs in Sub-Saharan Africa. *PLoS ONE*, 2013, 8(1):e53380.
55. Njeuhmeli E et al. Cost analysis of integrating the PrePex medical device into a voluntary medical male circumcision program in zimbabwe. *Submitted*, 2013.
56. WHO/ExpandNet. *Beginning with the end in mind: planning pilot projects and other programmatic research for successful scaling up*. Geneva, Switzerland, World Health Organization, Department of Reproductive Health and Research - ExpandNet, 2011. http://whqlibdoc.who.int/publications/2011/9789241502320_eng.pdf.

57. Dickson KE et al. Voluntary Medical Male Circumcision: A Framework Analysis of Policy and Program Implementation in Eastern and Southern Africa. *PLoS Med*, 2011, 8(11):e1001133.
58. Mwandu Z et al. Voluntary Medical Male Circumcision: Translating Research into the Rapid Expansion of Services in Kenya, 2008–2011. *PLoS Med*, 2011, 8(11):e1001130.
59. ISO 13485. Medical devices- Quality management systems- Requirements for the regulatory process. *International Organization for Standardization*, 2003.
60. Odeny TA et al. Text Messaging to Improve Attendance at Post-Operative Clinic Visits after Adult Male Circumcision for HIV Prevention: A Randomized Controlled Trial. *PLoS ONE*, 2012, 7(9):e43832.
61. WHO. *Male circumcision quality assessment toolkit*. Geneva, Switzerland, World Health Organization, 2009. http://whqlibdoc.who.int/publications/2009/9789241597517_eng.pdf.
62. PEPFAR. *PEPFAR's Best Practices for Voluntary Medical Male Circumcision Site Operations: a service guide for site operations* The President's Emergency Plan For AIDS Relief 2012. http://www.malecircumcision.org/resources/documents/VMMC_Best_Practices03.04.2013_web.pdf.
63. Plotkin M et al. "Man, what took you so long?" Social and individual factors affecting adult attendance at voluntary medical male circumcision services in Tanzania. *Global Health: Science and Practice*, 2013, 1(1):108-116.
64. UNAIDS. *UNAIDS Guidance Note on Developing a Communication Strategy for Male Circumcision*. Geneva, Switzerland, Joint United Nations Programme on HIV/AIDS 2010.
65. Rogers E. *Diffusion of Innovations*. 5th ed. New York, Free Press, 2003.
66. Herman-Roloff A et al. Acceptability of medical male circumcision among uncircumcised men in Kenya one year after the launch of the national male circumcision program. *PLoS ONE*, 2011, 6(4):e19814.
67. Khumalo-Sakutukwa G et al. Understanding and addressing socio-cultural barriers to medical male circumcision in traditionally non-circumcising rural communities in sub-Saharan Africa. *Culture, Health & Sexuality*, 2013:1-16.
68. Ssekubugu R et al. Contextual Barriers and Motivators to Adult Male Medical Circumcision in Rakai, Uganda. *Qualitative Health Research*, 2013, 23(6):795-804.
69. Chrouser K et al. Penile Measurements in Tanzanian Males: Guiding Circumcision Device Design and Supply Forecasting. *The Journal of Urology*, 2013, 190(2):544-550.
70. Global Harmonization Task Force Study Group 2. Medical devices post market surveillance: Global guidance for adverse reporting for medical devices. 2000.
71. WHO. *Use of devices for adult male circumcision in public health HIV prevention programmes: Conclusions of the technical advisory group on innovations in male circumcision*. Geneva, Switzerland, World Health Organization, 2012. http://whqlibdoc.who.int/hq/2012/WHO_HIV_2012.4_eng.pdf.

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