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COSTS AND IMPACTS OF SCALING UP VOLUNTARY MEDICAL MALE CIRCUMCISION IN TANZANIA

SEPTEMBER 2012

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EXECUTIVE SUMMARY

Tanzania is undertaking several activities to support the development of policy guidelines and a strategy for voluntary medical male circumcision (VMMC). Given the evidence of the effectiveness of VMMC in preventing the spread of HIV, the Government of Tanzania has adopted the medical practice as a prevention strategy. To plan for the most efficient and effective scale-up of services, it is useful to determine the costs and impacts of VMMC scale-up on the number of infections averted. This study therefore aimed to estimate the unit cost per VMMC across three different service delivery models, to help policymakers determine the costs and impacts of various options for scaling up VMMC services in the country.

The study used the Decision Makers' Program Planning Tool (DMPPT)[1] to estimate the cost and impact of scaling up VMMC on infections averted (http://www.malecircumcision.org). The cost analysis was conducted from the perspective of health providers in the Iringa, Mbeya, and Kagera regions. Three different VMMC delivery models (non-campaign, campaign, and mobile island outreach) were considered, allowing for comparison of the unit costs across service delivery models. Non-campaign sites are dedicated VMMC sites established at existing district and regional health delivery centers. The campaign service delivery model is coordinated from these dedicated sites and largely implemented in a stand-alone, temporary facility. Finally, the island outreach service delivery model comprises a team of VMMC providers offering services in hard-to-reach areas. In the regions studied, non-campaign sites were present in all three regions (Iringa, Mbeya and Kagera), the campaign model was used in just two regions (Iringa and Kagera), and the island outreach model was used in only one region (Kagera). A total of 12 sites were costed, representing three different service delivery models (some sites represented both campaign and non-campaign service delivery models).

Our analysis shows that the average unit cost of performing VMMC in Tanzania (across all service delivery models) is $46.61. Of the unit costs for non-campaign service delivery ($45.38), campaign ($45.98) and mobile ($128.60) service delivery models, the last was found to be significantly more expensive. This high cost is attributable to high indirect costs, which account for the largest share of the unit cost (64 percent) for island outreach sites. The relative costs of circumcision do not vary between campaign and non-campaign sites. For both these service delivery models, 70 percent of the costs at campaign and non-campaign sites are spent on salaries and consumables. The countrywide average unit costs for each type of service delivery model are derived by averaging the unit costs of the three regions, weighted according to number of circumcisions performed. Scaling up VMMC in Tanzania will yield significant benefits – around $6000 in savings for averted treatment costs for each infection averted, especially after the initial scale-up period. It is estimated that over a 15 year time frame a successful VMMC program in Tanzania can prevent one HIV infection for every 19 circumcisions performed.

In addition to estimating costs, the DMPPT projects the impact of VMMC on the number of new HIV infections. In the absence of VMMC the annual number of new infections is projected to rise from 84,000 in 2010 to 86,000 in 2025; but with VMMC, a significant decline to 64,000 is expected over the same time period. Over the 15 years from 2010–2025, VMMC could avert almost 197,000 or 14.5 percent of all new cases. Projected HIV infections decline marginally from 2010–2013 and the decline thereafter is much faster, illustrating the long-term positive impact of scaling up VMMC.

Scaling up adult VMMC to reach 80 percent of men between ages 15 and 49 in regions where current coverage is less than 80 percent (pushing the overall national coverage to 87.1 percent coverage by 2015)[2]

[1] The DMPPT and manual are available at: http://www.malecircumcision.org/programs/DMPPT.html.
[2] The national coverage estimate of 87.1% is based on estimates that the 8 targeted regions would reach an 80% coverage level and the 13 non-targeted regions would retain their current levels of coverage.

would avert nearly 28,000 new adult HIV infections through 2015 and almost 169,000 between 2016 and 2025—at an additional cost of $125.1 million through 2015 and an additional $59.5 million between 2016 and 2025. This would result in an average cost of $4,700 per HIV infection averted between 2010 and 2015, and $1,100 between 2010 and 2025. The results also indicate that increasing the prevalence of VMMC from current levels to 87.1 percent by 2015 would produce a discounted net savings[3] per infection averted of $6,300 during the 2010–2025 time period.

This analysis makes it clear that VMMC could have an immediate impact on HIV transmission, but the full impact on prevalence and deaths will only be apparent in the longer term—about 10–15 years from now. The reason is largely because VMMC averts infections some years into the future among people who have been circumcised. In the near term, the direct benefits of VMMC among men are likely to be greater than that for women, since VMMC will directly impact HIV infections among men. However, in the long run, both men and women will benefit substantially from the male circumcision program. The analysis shows that scaling up VMMC will have a significant effect on the incidence of HIV. The results, which are similar to findings from similar studies performed in Kenya, Zambia, and Zimbabwe, show that with 80 percent coverage in the eight targeted regions, HIV incidence would fall significantly in Tanzania from 0.39 percent in 2010 to 0.26 percent by 2025.

While the results indicate that scaling up VMMC coverage to 80 percent by 2015 in the targeted regions would significantly reduce the number of new HIV infections, this would require increasing the annual number of circumcision procedures from around 410,000 in 2010 to about 1.3 million in 2013 before leveling off to about 480,000 after 2015. In addition, scaling up VMMC to reach the target by 2015 will require a rapid increase in the number of circumcisions performed for the years 2010–2015, which will be achieved in large part through intensified efforts to provide VMMC to the existing cohort of uncircumcised men in the country.

[3] Net savings are defined as the cost per infection averted relative to the discounted lifetime cost of treatment.

ABBREVIATIONS

AIDS	Acquired Immune Deficiency Syndrome
CDC	Centers for Disease Control and Prevention
DHS	Demographic and Health Survey
DOD	(United States) Department of Defense
DMPPT	Decision Makers' Program Planning Tool
HIV	Human Immunodeficiency Virus
HPI	Health Policy Initiative
HTC	HIV Testing and Counseling
ICAP	International Center for AIDS Care and Treatment Programs
IEC	Information, Education, and Communication
MCHIP	Maternal and Child Health Integrated Program
MOHSW	Ministry of Health and Social Welfare
MOVE	Models for Optimizing the Volume and Efficiency
MSD	Medical Stores Department
NACP	National AIDS Control Program
NGO	Nongovernmental Organization
PITC	Provider-Initiated Testing and Counseling
RA	Research Assistants
TWG	Technical Working Group
UNAIDS	Joint United Nations Program on HIV/AIDS
USAID	United States Agency for International Development
VCT	Voluntary Counseling and Testing
VMMC	Voluntary Medical Male Circumcision
WHO	World Health Organization

I. INTRODUCTION

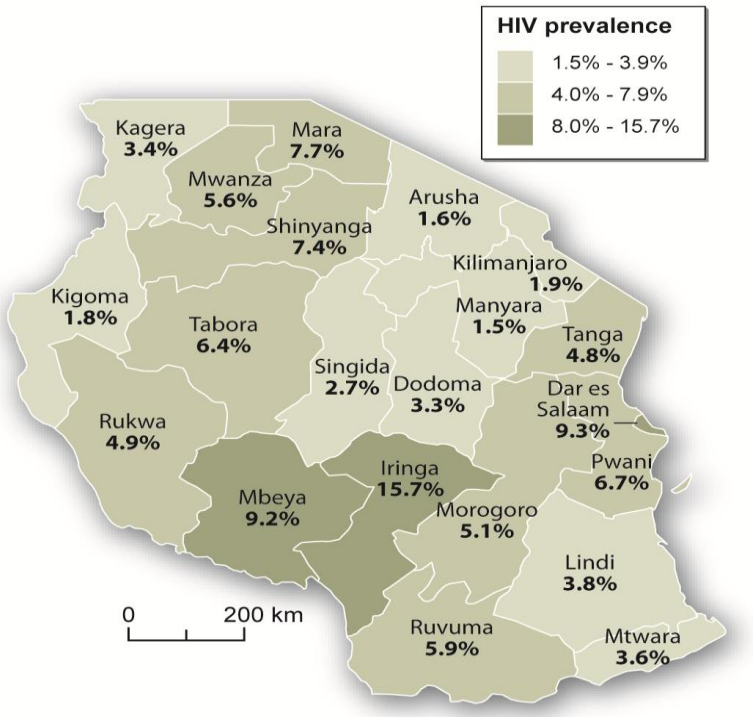
There is now clear evidence that VMMC significantly reduces the risk of heterosexually acquired HIV infection in men by approximately 60 percent. This finding has been supported by at least three randomized controlled clinical trials, which indicate that men who undergo VMMC by trained health professionals in properly equipped settings show lower levels of HIV infection than uncircumcised men (Auvert et al., 2005; Bailey et al., 2007; Gray et al., 2007; and William et al., 2006). Biological studies of the foreskin also show that it contains a high concentration of cells susceptible to HIV infection. This is one of three potential biological explanations of why circumcision may reduce HIV infection (the other two being a reduction in sexually transmitted infections and a reduction in the likelihood of microtears and trauma to the foreskin).

Based on the data from the clinical trials, it is estimated that circumcision across sub-Saharan Africa could prevent up to 3.36 million new HIV infections, resulting in net savings (due to averted care and treatment costs) amounting to $16.51 billion[4] between 2011 and 2025 (Njeuhmeli et al., 2011). In light of conclusive evidence that VMMC provides partial protection against HIV acquisition for men, the World Health Organization (WHO) and Joint United Nations Program on HIV/AIDS (UNAIDS) recommended that VMMC programs be added to the existing comprehensive HIV prevention package of services in countries with predominantly heterosexual epidemics (WHO, 2010). The government of Tanzania has identified low prevalence of VMMC as a contributing factor to the spread of HIV in some regions in the country, and following the WHO-UNAIDS recommendation, has incorporated VMMC in the HIV prevention portfolio.

WHO and UNAIDS, in collaboration with the U.S. President's Emergency Plan for AIDS Relief (PEPFAR), have been supporting countries with information and tools to assess the current situation and develop future plans for VMMC scale-up. Part of this work involved a collaboration between UNAIDS and the USAID | Health Policy Initiative (HPI), Task Order 1, to develop the Decision Makers' Program Planning Tool (DMPPT), which estimates the potential impact and costs of alternative approaches to scaling up medical VMMC services (Bollinger et al., 2009a). This tool has been previously applied as part of a desk review in 13 countries in sub-Saharan Africa (Tanzania included) to provide information for countries' VMMC policy development. Although the tool was used to estimate the impacts of a VMMC campaign in Tanzania, certain variables and inputs comprised regional averages or estimates that were not always based on country-specific unit costs or approved epidemiological and demographic data. This initial desktop exercise aimed to inform decision makers in the early stages of formulating country policies with respect to VMMC. UNAIDS and WHO have encouraged on-going use of the DMPPT to guide the development of policy and implementation of the VMMC program, and to refine cost estimates. As a result, the Tanzania Ministry of Health and Social Welfare (MOHSW) requested technical assistance from the USAID | Health Policy Initiative Costing Task Order to guide the application and use of the DMPPT, while incorporating up-to-date and accurate costing data. Figure 1 shows the rates of HIV prevalence across Tanzania.

[4] All costs are in US$ unless otherwise noted; exchange rate: US$1 = Tsh 1469 (2010).

Figure 1. HIV prevalence in Tanzania



Tanzania Commission for AIDS (TACAIDS), Zanzibar AIDS Commission (ZAC), National Bureau of Statistics (NBS), Office of the Chief Government Statistician (OCGS), and Macro International Inc. 2008. Tanzania HIV/AIDS and Malaria Indicator Survey 2007-08. Dar es Salaam, Tanzania: TACAIDS, ZAC, NBS, OCGS, and Macro International Inc.

1.1. Voluntary Medical Male Circumcision in Tanzania

Tanzania has undertaken several activities to support the development and implementation of a VMMC program in the country. In 2006, the government of Tanzania conducted a country stakeholders' consultation meeting to review and discuss the available evidence on the protective effect of VMMC on HIV infection at global, regional, and country levels and to discuss various issues related to VMMC, i.e., acceptability, risks, barriers, health service delivery, traditional practices, counseling and consent, human rights, ethical and regulatory issues, and program strategies (MOHSW, 2009).

In 2009, the MOHSW assessed the current situation of male circumcision in the country and commissioned the National Institute for Medical Research to investigate the acceptability and feasibility of carrying out VMMC services in health facilities. The findings from the study provided critical information for the scale-up of safe circumcision services in Tanzania (MOHSW, 2009). Based on the study findings, the report recommended that VMMC be considered as part of a comprehensive HIV prevention package.

Following the situational analysis report, the MOHSW developed a National Strategy for VMMC for HIV Prevention in Tanzania. The strategy provides a platform for policymakers, program managers, implementing partners, and public and private health providers to identify key milestones for scaling up male circumcision. The strategy outlines the goal to reduce new HIV infections among males, and indirectly among females, by increasing the prevalence of circumcision to 80 percent in eight regions (MOHSW, 2010). It also recommends focusing efforts on male circumcision in areas where HIV

prevalence is 15 percent or more and circumcision prevalence is less than 20 percent. In addition, VMMC activities are to focus on men ages 10–24 years because they are already sexually active or will soon become sexually active. The strategy also recommends that the delivery of VMMC services be integrated within the existing public and private health delivery system, comprising referral, specialized, regional, and district hospitals and primary health facilities.

To operationalize the VMMC strategy, the MOHSW identified eight regions as phase one regions to scale up VMMC services based on high HIV prevalence levels and low male circumcision levels: Iringa, Mbeya, Shinyanga, Rukwa, Tabora, Mwanza, Kagera, and Mara. The strategic plan outlines the initial scale-up of VMMC using three approaches within these eight low circumcision prevalence regions:

- Short-term adult VMMC (15–34 years) program[5] lasting five years and delivered through public, private nongovernmental organization (NGO), integrated/non-campaign, and outreach clinics
- Medium-term adolescent VMMC program for 10–14 year olds
- Long-term neonatal VMMC program targeting neonates and fully integrated in existing health services

To scale-up VMMC in the country, the Tanzania government established a national VMMC Technical Working Group (TWG), led by the MOHSW, comprising a broad range of representatives from government departments at the national, regional, and district levels; development partners; key civil society organizations; and networks of people living with HIV. The mandate of the VMMC TWG is to

- Lead and coordinate the scale-up of VMMC activities in the country,
- Advise the MOHSW and its partners, and
- Provide the necessary technical guidance in planning for the scale-up and oversee the implementation of a national VMMC program.

Regional planning meetings were organized in the eight low circumcision selected regions to develop VMMC action plans and budgets. Each regional working groups developed two-year plans (2011–2012) for VMMC, targeting the first (10–24 years) and second (25–34 years) priority age groups.

Other events in the operationalization of the VMMC strategy included the following:

- Maternal and Child Health Integrated Program (MCHIP) (USAID-funded program managed by Jhpiego) training for new providers in VMMC service provision.
- Establishment of demonstration sites in Mbeya, Iringa, and Kagera.
- Sensitization meetings with stakeholders at regional and districts levels to mobilize the community and create demand for rapid scale-up of VMMC and plan implementation. These meetings served to help
    - Develop and produce technical and financial materials to facilitate plan implementation;
    - Identify development partners, NGOs, and human resources to implement services;
    - Approve the use of government facilities for campaigns;
    - Create local ownership of campaigns; and

[5] Although the country program focuses on adults age 15 to 34, the model used in this analysis includes VMMC for adult males age 15 to 49 to allow for comparison with estimates from other countries.

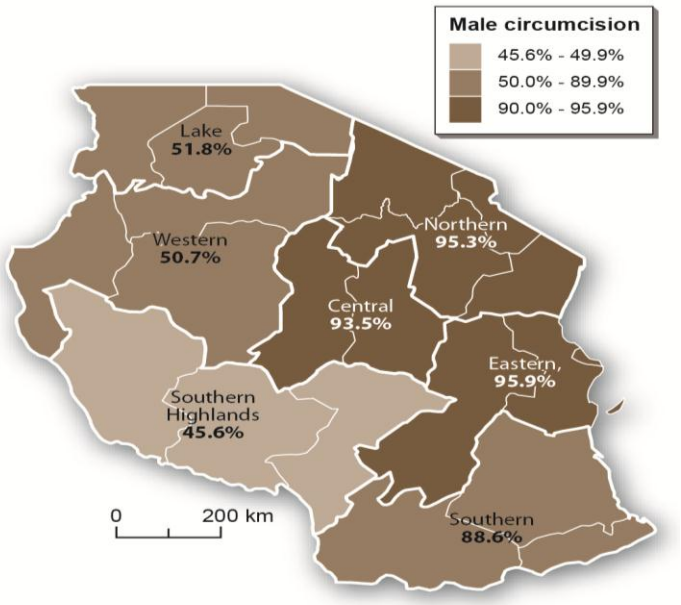
- Provide a forum for the creation of a taskforce to oversee the planning and implementation of campaigns.

- Formation of a steering committee at the regional and district levels.
- Formation of a technical committee at the district level and establishment of a demand-creation task force at the regional level.

At each site, all stakeholders and the community health management teams participated in an orientation workshop on VMMC services. The partners also conducted needs assessments for equipment and infrastructure renovations, after which a memorandum of understanding was drafted between the development partner supporting VMMC in the region and each site.

The delivery of VMMC services in Tanzania incorporates many of the recommendations for increasing program efficiency that were outlined in WHO's "Models for Optimizing the Volume and Efficiency of MC Services (MOVE)." The WHO guidelines recommend increasing efficiencies in use of staff time and facility space, and also propose strategies to increase productivity of program managers, while ensuring high quality of service delivery. These strategies include optimizing the use of facility space (using multiple surgical beds in one room); maximizing staff time (using the forceps-guided surgical technique, task shifting and task sharing); using VMMC kits that include disposable consumables and sets of reusable or disposable surgical instruments; and employing a multi-disciplinary team of trained and certified providers drawn from available service providers in health facilities to provide VMMC services. The recommended team of providers includes a surgeon (medical officer, assistant medical officer, clinical officer, or trained nurse); surgical assistant; and trained counsellor to provide counselling and testing services. The degree of MC prevalence in Tanzania is shown in Figure 2.

Figure 2. VMMC prevalence in Tanzania[6]



National Bureau of Statistics (NBS) [Tanzania] and ICF Macro. 2011. Tanzania Demographic and Health Survey 2010. Dar es Salaam, Tanzania: NBS and ICF Macro.

[6] Male circumcision estimates are also available from the Tanzania HIV/AIDS and Malaria Indicator Survey (2007-08)

1.2. Description of the DMPPT and VMMC Costing Workbook

The DMPPT was developed to support policy formulation and planning for the scale-up of safe VMMC services. It enables analysts and decision makers to understand the costs and impacts of policy options regarding VMMC. The tool is part of a bigger toolkit developed by the WHO and UNAIDS that provides guidelines on comprehensive approaches to VMMC, including types of surgical procedures and key policy and cultural issues (WHO and UNAIDS, 2008). As noted earlier, the DMPPT is designed to help countries collect and analyze information to provide policymakers and planners with insights into several key questions, such as the following:

- How much will it cost to scale up VMMC services?
- What is the expected impact of scaling up VMMC services? How many infections could be averted?
- What is the impact of providing VMMC to all adult men versus targeting services to adolescents, young men, newborns, men at high risk of HIV, or other special populations, such as the military or university students?
- What targets are feasible and how quickly can services be scaled up?
- How do the costs vary depending on the delivery strategy, including the types of facilities that will offer services?
- Is VMMC cost-effective when compared to other prevention interventions?
- Will VMMC result in cost savings when compared to antiretroviral treatment costs?
- How can VMMC be integrated into a comprehensive package of prevention services for men at the service delivery sites?

The DMPPT has two modules: costing and impact. The first component comprises a Male Circumcision Costing Workbook (MC Workbook), which is an Excel workbook that has been designed to facilitate the development of a unit cost for male circumcision at the facility level. The tool requires the collection and analysis of direct costs (personnel, VMMC commodities, and training) and indirect costs (indirect personnel, overhead, and capital). Capital and initial training costs are annualized for inclusion in the unit cost analysis.

The impact module requires key input assumptions about the epidemiological and demographic data in the country (demographic data, current prevalence of male circumcision, and sexual behavior of the target group, HIV prevalence trends, priority populations, target coverage levels, and service delivery models). Other inputs include the unit cost of circumcision in various settings (which is derived from the cost module) and the mix of service delivery methods. These assumptions are used to examine the impact of VMMC scale-up on infections averted and the associated costs.

In estimating the contribution of direct personnel costs, the time spent on each circumcision case is taken into account. The time spent on each male circumcision is then multiplied by the hourly rate of the clinical personnel. Although the cost associated with demand creation is calculated in the tool, it does not contribute to the unit cost of VMMC. Instead, national-level demand-creation costs are included in the DMPPT as a lump-sum annual expense. The reason for excluding the demand-creation costs in facility-based unit costs is because the amount spent on demand creation is not directly related to the number of clients who are circumcised at the facility level.

1.3. Study Objective

The primary objective of this study was to determine the costs and impacts of various options for scaling up VMMC in Tanzania, to inform the MOHSW's plans for scaling up the country's VMMC national program. The results provide information on the unit costs of performing VMMC for different service delivery models, and also provide an approximate estimate of total resources required to scale up VMMC services throughout the country. The data will inform policymakers, planners, and funders of the true costs of providing VMMC services using different service delivery models. These data will be used to help the MOHSW plan for and mobilize additional resources for VMMC program implementation.

The specific objectives of the activity were to:

- Calculate accurate unit costs for specific types of VMMC service delivery in Tanzania;
- Update the DMPPT with the latest demographic and epidemiological data and facility-based costing information; and
- Provide an estimate of resources required for scaling up VMMC to the target coverage level, and project infections averted as a result of scale-up.

2. METHODOLOGY

2.1. Study Design

This study used a cross-sectional design and employed both qualitative and quantitative techniques. The study approach consisted of the steps summarized in Table 1.

Table 1. Overview of study design and approach

Steps	Description
Step 1: Scoping mission	This step involved discussions with key stakeholders [representatives of the MOHSW, National AIDS Control Program (NACP), TWG, and development partners supporting VMMC in Tanzania including PEPFAR (USAID, CDC, DOD), UNAIDS, and WHO] regarding the proposed methodology and scope of the costing activity. The suggestions from the various groups informed the scope of the VMMC costing. Initial sites for data collection were also identified.
Step 2: Recruitment of research assistants and national consultant	This second step involved interviewing potential data collectors and the national consultant for the VMMC costing activity. The interviewing panel included the international consultant, NACP senior staff, and a member of the Tanzania TWG from the Department of Defense (DOD). Four research assistants and a national consultant were recruited.
Step 3: Training on the DMPPT	The next step focused on training for VMMC regional coordinators, Tanzania TWG members, NACP staff directly involved in the coordination of VMMC activities, research assistants, and the national consultant on: (1) the DMPPT, (2) the nature of information to be collected and (3) previous VMMC studies conducted in other countries. It also provided an opportunity to share with the participants the country's progress with VMMC and strategies for scaling up VMMC services. The process of data collection was also reviewed to gain a better understanding of the nature of the data required to estimate the unit cost of delivering VMMC services with various service delivery models.
Step 4: Development and approval of the VMMC protocol	This involved revision of the VMMC protocol for Tanzania based on input from key stakeholders supporting VMMC activities in Tanzania i.e., DOD, USAID, International Center for AIDS Care and Treatment Programs (ICAP), NACP, MOHSW, Futures Group and Futures Institute. The protocol was then submitted to the Tanzanian Ethics Committee and the Futures Group internal IRB board for approval. Various documents on VMMC guidelines were reviewed and provided the framework for the VMMC costing in Tanzania. In particular, the MOVE approach and the waste management components were reviewed and provided detailed guidelines on the VMMC commodities recommended for use in Tanzania.
Step 5: Training of RAs and the national consultant	This step included training for research assistants and the national consultant on the data collection form and specifically focused on the nature of data to be collected from the sites, the technique of administering the data collection form, and the nature and type of national data required as input to the impact model. The timeline for the pre-testing and actual data collection was finalized during this phase.
Step 6: Data collection in selected regions	Data collection took place at the selected sites, as well as at the national level. National data included demographic and epidemiological information, and prices for VMMC commodities and equipment from key partners supporting VMMC activities in Tanzania and from the Medical Stores Department (MSD).
Step 7: Estimation of unit costs	The unit cost workbooks were populated and unit costs developed on the basis of the data collected and documented in the data collection templates.
Step 8: Population of the DMPPT and analysis of output	Using the demographic, epidemiological, and costing data, the DMPPT was populated for Tanzania and results were produced for economic analysis purposes. To facilitate the analysis, a number of scenarios were developed with different assumptions about the mix of service delivery models, coverage targets, scale-up rates, timeframes, and target population.

Source: Study authors.

2.2. Study Population

Selection of sites

Tanzania's National Multisectoral HIV Prevention Strategy 2009–2012 recommends a targeted scale-up of VMMC in eight out of the 21 regions that have the highest burden of HIV and lowest prevalence of male circumcision (MOHSW, 2010). The eight regions for initial scale-up include Iringa, Kagera, Mara[7], Mbeya, Mwanza, Rukwa, Shinyanga, and Tabora. Table 2 outlines both male HIV prevalence and MC prevalence in each of the regions.

Table 2. Male HIV prevalence and male circumcision prevalence in Tanzania

Targeted Regions	HIV Prevalence	MC Prevalence
Iringa	15.7%	37.7%
Kagera	3.4%	26.4%
Mbeya	9.2%	34.4%
Mara	7.7%	89.0%
Mwanza	5.5%	54.1%
Rukwa	4.9%	31.4%
Shinyanga	7.4%	26.5%
Tabora	6.4%	42.8%
Non-targeted Regions	**HIV Prevalence**	**MC Prevalence**
Dar es Salaam	9.3%	97.9%
Ruvuma	5.9%	68.9%
Pwani	6.7%	96.9%
Morogoro	5.1%	93.1%
Lindi	3.8%	93.3%
Tanga	4.8%	95.0%
Dodoma	3.3%	96.9%
Mtwara	3.6%	93.1%
Singida	2.7%	90.9%
Kilimanjaro	1.9%	97.0%
Manyara	1.5%	97.3%
Arusha	1.6%	96.2%
Kigoma	1.8%	68.4%

Source: MOHSW, 2010. *National Strategy for Scaling Up Male Circumcision for HIV Prevention.*

[7] While the prevalence of male circumcision in Mara already exceeds 80 percent, the Rorya District in the Mara region has an MC prevalence of only 30 percent and thus was the focus of the analysis.

As mentioned earlier, VMMC implementation began in three demonstration regions: Iringa, Mbeya, and Kagera. Per the recommendation of the MC TWG and the MOHSW/NACP, all three regions were included in this unit cost assessment. The distribution of facilities by location and service delivery model in each of the three regions is shown in Table 3. A total of 12 sites were costed, some of which offered VMMC as part of both a campaign and non-campaign service delivery model. As a result, 14 unit costs were developed (11 non-campaign, 2 campaign and 1 island).

Table 3. Distribution of facilities by location and service delivery model

Region	Implementing Partner/Donor	No. of Sites	Name of Site	Location	Service Delivery Model	Commencement Date of VMMC Services
Iringa	MCHIP	5	Ngome Health Center	Iringa urban	Non-campaign	June 2010
			Mafinga District Hospital	Mufindi	Non-campaign	June 2010
			Iringa Regional Hospital	Iringa urban	Non-campaign & Campaign	September 2009
			Tosamaganga DD Hospital	Iringa rural district	Non-campaign	June 2010
			Lugoda Hospital	Mufindi District	Non-campaign	June 2010
Mbeya	DOD	4	Mbeya Referral Hospital	Mbeya MC	Non-campaign & Campaign	March 2010
			Mbeya Regional Hospital	Mbeya MC	Non-campaign	September 2010
			Metta Maternity Hospital	Mbeya MC	Non-campaign	May 2010
			Mbalizi Military Hospital	Mbalizi District	Non-campaign	January 2010
Kagera	ICAP	3	Kagera Regional Hospital	Bukoba	Non-campaign	October 2009
			Rubya Designated District Hospital	Rubya	Non-campaign	September 2010
			Goziba in Lake Victoria		Mobile island	January 2011 (Campaign)

2.3. Service Delivery Models for Voluntary Medical Male Circumcision in Tanzania

Scaling up VMMC to reach the target of 87.1[8] percent of all adult and newborns in Tanzania requires various service delivery models. The 87.1 percent target for male circumcision was obtained first by assessing the current coverage by region, which was available from the 2010 National Strategy for Scaling Up Male Circumcision for HIV Prevention. Regions where coverage is currently less than 80 percent were assumed to achieve 80 percent coverage, while regions where male circumcision was already above 80 percent were assumed to remain at current levels. When the coverage rates for each region were averaged together, the nationwide target for circumcision coverage was determined to be 87.1 percent.

In areas with traditional cultural male circumcision, the scale-up strategy is aimed at promoting VMMC services within existing health facilities. In non-circumcising areas, the recommended approach is to promote and scale up: (1) non-campaign facility services in regional and district hospitals, (2) outreach services (health centers and dispensaries), and (3) mobile service delivery among hard-to-reach populations.

Tanzania has adopted three VMMC service delivery models, each of which is summarized below:

Non-campaign. This is a dedicated service delivery model established within the existing public and private health delivery system (including district, regional, and referral hospitals and health centers). Each site has a minimum of four beds per surgical room and is staffed by a team of six VMMC providers (one medical officer, two bed nurses, one counselor, one follow-up nurse, and one nursing assistant) and a cleaner. To optimize service delivery, the medical officer/clinical officer or a physician performs some steps of the surgery including removal of the foreskin, hemostasis, and placement of the four mattress sutures, while the nurse aides perform all the other surgical steps including preparation of the patient, injection of the anesthetic, placement of secondary sutures, and bandaging. This gives the surgeon more time to focus on providing additional circumcisions. The VMMC counseling services and HIV counseling and testing (HTC) services are provided by the counselors who are also trained nurses. On average, this team can carry out 30–60 circumcisions per day depending on demand.

Campaign. These are coordinated from the dedicated sites and, at present, are primarily implemented within existing facilities (usually a district, regional, or referral hospital and health center) by MCHIP and ICAP in order to meet the demand for VMMC services. The campaign service delivery model occurs at fixed sites but provides services as part of a campaign event. The campaign site is assigned to co-site managers, which are usually the medical officers in charge of the facility and a staff member from the partner supporting the VMMC services in the region. The co-site manager is responsible for the day-to-day activities and oversees all logistics for human resources and supplies in the site. In addition to the co-site manager, each site has between two and three surgeons, four to eight bed nurses, two to four VMMC counselors, one data clerk, one equipment/commodity manager, one equipment sterilizer, one receptionist, two decontamination personnel, one store keeper, one follow-up nurse, one post-operation nurse, one runner nurse, and a driver.

[8] This is extrapolated from regional coverage estimates in the 2010 Demographic and Health Survey (DHS). The proportion of total population circumcised is arrived at by calculating the proportion of percent circumcised in each region to the total population in that region (based on DHS sample size). The total for all regions gives us the national average of the circumcised population in the country.

On average, the team performs about 40 to 100 circumcisions per day depending on demand. All the counselors working in the campaigns have undergone facility-based training in HIV testing and counseling (HTC). Where there is a shortage of counselors, outreach HTC partners relocate to the campaign sites. The target group during campaigns includes young males who are not sexually active and young males aged 10 to 24 years (as per the national strategy). During the campaigns, the strategy for demand creation employs peer educators (especially those already circumcised); community mobilization through radio ads; and distribution of information, education, and communication materials.

Mobile/Island Outreach. This service delivery model comprises a team of VMMC providers offering services in hard-to-reach areas, with services being coordinated from a non-campaign site located at a hospital. Island outreach to the islands of Lake Victoria is one example of a mobile service delivery model. Traditionally the islands have lacked access to many health interventions, given the relatively small populations and the difficulty of reaching individuals on these islands. However, given the mobility of fishermen on these islands, the population is perceived to be at high risk of HIV infection. Thus VMMC interventions on these islands were prioritized.

In the case of Kagara, this service delivery model is coordinated from the non-campaign site at Kagera Regional Hospital. The island outreach team travels to the islands by boat with all the necessary equipment and commodities required for an island outreach operation. Because of a lack of health facilities on some of the islands, outreach activities are carried out in special tents acquired for VMMC services. The team comprises two surgeons, four bed nurses, two VMMC counselors, one data clerk, one equipment/commodity manager, one equipment sterilizer, one receptionist, two decontamination personnel, one store keeper, one follow-up nurse, one post-operation nurse, one runner nurse, government officials, the medical officer in charge, and the VMMC coordinator in the region. All the counselors working in the mobile sites have undergone facility-based training in HTC.

2.4. Data Collection, Management, and Analysis

This section briefly describes the data collection, management, and analysis processes.

Development of survey instrument

A detailed data collection survey was used in Tanzania to gather information in the demonstration sites. The survey was based on existing data collection tools used in other countries and modified to reflect specific information required in the Tanzanian setting for calculation of the unit cost. The survey enables the collection of financial data, operational data, and VMMC programmatic data. Most financial information (e.g., price of commodities and equipment) were extracted from the database of partners supporting VMMC services in each region. Additional information on the number of VMMC completed, cost of training, number of personnel trained, and prices of drugs and supplies were obtained from the partners. A copy of the survey is attached as Annex C.

Selection of research assistants

The research assistants hired to collect data were interviewed by a panel of senior NACP staff, the DOD representative, and the international consultant. A total of four research assistants were recruited. The team included two pharmacists with prior experience in data collection and two data collectors with a background in social work. The research assistants were trained using the survey before commencing the exercise. In addition, all the data collectors attended the DMPPT training with the NACP VMMC regional coordinators and representatives from development partners supporting VMMC activities in Tanzania.

Sources of data

Data were collected from various sources. Tables 4 and 5 summarize the most important data sources for the various components of the unit costing tool and the DMPPT.

Data capturing and analysis

All the data collected were checked and entered by the international consultant and study investigators into the unit costing tool and the DMPPT. Prior to data capturing, the unit costing workbooks were adjusted to take into account the additional input data, including waste management.

Cost analysis

The cost analysis was divided into two components: (1) defining the intervention (based on the VMMC protocol and conducting key informant interviews with current providers of circumcision); and (2) costing adult[9] VMMC (collecting direct and indirect cost data—financial, human resources, drugs, supplies, and equipment costs—from providers). An ingredients approach to costing was followed, whereby all the inputs were listed and their contribution to the overall cost was then quantified. Different service providers and service delivery models (non-campaign, campaign, and island outreach) were considered, allowing for comparison and validation. The costing was largely informed by the actual costs incurred at the selected sites. Personnel costs for clinical staff were calculated at a rate equal to that currently being paid to doctors and nurses working in the public sector, with the exception of Ngome Hospital, a private facility. The salary scale for health personnel is relatively higher than the government rate for permanent staff. The unit costs were adjusted for the probability of, and cost associated with, complications.

Table 4. Summary of data sources—costing

Type of Data	Source of Data
Programmatic and non-financial operational data	Programmatic data were collected through key informant interviews at the facility. Informants included the doctors and nurses responsible for male circumcision and counseling, as well as senior administrative staff. In all sites, the number of circumcisions completed was extracted from the VMMC register at the facility.
Staffing and time spent	Information on time taken for the VMMC activities was obtained through interviews with key informants in the facility. In several of the sites, the time taken for VMMC procedures was estimated by the VMMC providers. A time-motion study, evaluating time required for each procedure, was not performed as part of this study. Staff salaries were extracted from official government pay scales for each cadre, while information on overtime allowance was obtained from key informants at the facility. In addition to the interviews, some information on allowances paid to VMMC providers was obtained from the partners supporting VMMC activities in the region. This information was used to validate questionnaire information with respect to additional allowances paid by partners to VMMC service providers.
Equipment, commodities, and consumables and supply chain management	The cost of equipment, commodities, and consumables were extracted from official invoices provided by partners supporting VMMC services in each region. For Iringa, the price of equipment, commodities, and consumables came from MCHIP. In Mbeya and Kagera, the prices of commodities, equipment and supplies came from the Medical Stores Department (MSD). Both the MSD prices and those obtained from MCHIP include the cost of supply chain management (e.g., logistics, warehousing, and distribution to the sites).

[9] The focus of this cost analysis was to calculate the unit cost of an adult male circumcision. Further analysis is required to assess how the cost of neonatal circumcision would differ from the cost of adult male circumcision.

Type of Data	Source of Data
Training costs	The training costs were based on actual training expenditure for VMMC providers and counselors. Almost all the VMMC providers in the three regions were trained by MCHIP. The cost of training covered per diems for the trainers, trainees, and counselors; training materials; cost of the training venue; transport reimbursement for the trainees and trainers; and the cost of refreshments. The cost per person was obtained by dividing the total cost of training VMMC providers/counselors by the number of participants. Training costs were assumed to be repeated every three years. The cost per trainee was therefore divided by three to obtain the contribution of training to the unit cost of male circumcision.
Overhead and operational costs	The overhead and operational costs (utilities and maintenance) for each site were derived from the facility general ledger or summary ledger reports. In addition, information on the type and number of support staff was obtained through interviews with key informants at the facility.
Administrative and program costs	This expenditure item refers to facility overhead costs. It was assumed that each medical officer in charge of the facility, though not directly involved in the provision of VMMC services, played a key role in overseeing the delivery of services in the facility, including VMMC services. In each facility, the team collected information on the salaries of the medical officer in charge and the hospital administrator. Their contribution was based on the facility share of VMMC relative to the other services provided at the facility. However, patient expenditure related to VMMC, was not collected. This is because the costing assumed a government perspective or health system perspective.
Land and buildings	The cost of each facility was estimated using information provided by the MOHSW. MOHSW has estimates of sizes of public health facilities, as well as the cost of construction per square meter. This information was used to estimate the cost of construction of each health facility surveyed. Information on the lifespan of the building was obtained from previous studies. It was assumed that the lifespan for buildings in East Africa remains the same.
Volume of services	Information on inpatient and outpatient services was extracted from the facility registers. The nature of data collected includes inpatient admissions for the overall facility, adult male circumcisions (normal and complications), and total outpatient visits for all the conditions.
Current coverage of adolescent prior to sexual debut	The calculation of the current coverage was based on DHS data for 2010.
National-level demand-creation costs	National-level demand-creation costs were based on estimates provided by the NACP.

Table 5. Summary of data sources—impact model data

Type of Data	Source of Data
Demographic data	Demographic data was extracted from Spectrum[10] estimates for Tanzania developed in March 2011.
Epidemiological data	The HIV prevalence was derived from the Tanzania Malaria and Indicator Survey (2008), while the HIV projections were generated using the UNAIDS Epidemic Projection Package and AIDS Impact Model, part of Spectrum. Other behavioral information was obtained from the 2011 Tanzania Demographic and Health Survey (DHS).

[10] Spectrum is a Windows-based system of integrated policy models that analyze existing information to determine the future consequences of today's development programs and policies. More information on the Spectrum models can be found at http://www.futuresgroup.com/resources/software_models/spectrum.

Three sets of unit costs were calculated for the non-campaign, campaign, and island outreach service delivery models. The rationale for keeping the unit costs separate was that there were important differences in various components of the models; for example: (1) the number of VMMC providers involved in the service provision during the campaigns is higher than non-campaigns; (2) during campaigns additional surgical bays are added per site; (3) the campaign model fully utilizes the bays during the VMMC campaigns, whereas the other models do not; and (4) a significantly higher number of VMMCs are performed during the campaign period relative to the non-campaign periods. The weighted unit cost for non-campaign, campaign, and island outreach sites in each region were used to generate an average weighted unit cost per type of service delivery model in Tanzania. Overhead costs such as equipment, utilities, transport, maintenance, and support were calculated based on the relative share of VMMC compared to the total facility workload.

Two key scenarios were developed for analysis purposes. The first scenario assumes achievement of the national VMMC coverage of 87.1 percent of the target group (males ages 15–49) by 2015. The second scenario assumes that coverage will remain the same (i.e., 66.8% of all adult males are circumcised). The 87.1 percent was calculated using data on male circumcision in the Demographic and Health Survey (DHS) for 2010.

Finally, the analysis adopts the perspective of a service provider in Tanzania and costs are for 2010. When conducting the cost-effectiveness analysis, future costs and benefits are discounted to 2010 at 3 percent annually. This discount rate has been recommended by UNAIDS and has been used in previous VMMC costing studies (Auvert et al., 2008; and Bollinger et al., 2009b). Costs incurred by VMMC clients (e.g., client travel costs, clients' opportunity cost of travel time, their opportunity cost of post-operative healing time, etc.) were excluded from the analysis.

Quality assurance and validation of the data

The team followed an internal and external process for ensuring quality of data collection and outputs from the unit costing tool and DMPPT. The data recorded on the surveys were captured by the co-principal investigator and international consultants and entered into the unit costing tool. The lead consultant and the team leader checked the unit cost calculations and analysis spreadsheets for accuracy, completeness, and reasonableness. The international consultant conducted a site visit and checked and traced, on a sample basis, some of the questionnaire data back to source data at the site.

Validation of data and output was carried out by Ms. Veena Menon, Futures Group; Dr. Steven Forsythe, Futures Institute; and USAID and UNAIDS staff members. Formal dissemination of the cost study findings to a wider audience, such as the inter-agency task force on VMMC, had not yet taken place at the time of writing this report.

3. RESULTS OF COSTING AND MODELING

3.1. Cost of VMMC per Service Delivery Model: Campaign vs. Non-Campaign

In Iringa, Mbeya and Kagera, both campaign and non-campaign service delivery models were delivered in fixed health facilities. Table 6 shows the weighted average cost per VMMC for non-campaign service delivery in Iringa, Mbeya, and Kagera. The costing took into account both the direct (consumables, non-consumable supplies, and personnel costs) and indirect costs (capital, maintenance and utility, support personnel, and management and supervision costs). The weighted average cost of performing VMMC at a non-campaign site in Iringa was $48.28 (Tshs 70,923.32).[11] The cost per VMMC in Mbeya and Kagera was estimated at $47.51 (Tshs. 69,792.19) and $36.07 (Tshs. 52,986.83), respectively. Regarding the number of VMMC performed annually, Mbeya reported the largest number (10,568), followed by Iringa (5,244) and Kagera (4,057). The wait list in some sites in Mbeya (e.g., Mbalizi Military Hospital) was well above 3,000. The unit costs in Kagera are relatively low largely because of task shifting. In Kagera, the VMMC were performed mainly by clinical officers and nurses, the salaries of which are much lower than physicians and medical officers. The costs for non-campaign sites are consistent with values reported from VMMC costing studies in Kenya, Uganda, Zambia, and South Africa, which range from $31.84 in Kenya to $100.07 in Zimbabwe.

Table 6. Overview of VMMC unit costs during non-campaign service delivery

	Iringa		Mbeya		Kagera		Tanzania Average	
Number of VMMCs	5,244		10,568		4,057		19,869	
	Cost US$	**%**	**Cost US$**	**%**	**Cost US$**	**%**	**Cost US$**	**%**
Direct costs								
Consumables costs	11.04	23%	16.70	35%	16.79	47%	15.22	34%
Non-consumable supplies costs	0.13	0%	0.07	0%	0.10	0%	0.09	0%
Personnel costs	18.57	38%	18.06	38%	12.16	34%	16.99	37%
Training costs	12.46	26%	10.35	22%	5.03	14%	9.82	22%
Sub-total	42.20	87%	45.18	95%	34.07	94%	42.12	93%
Indirect costs								
Capital costs	1.14	2%	1.57	3%	1.42	4%	1.43	3%
Maintenance and utility costs	3.99	8%	0.16	0%	0.36	1%	1.21	3%
Support personnel costs	0.36	1%	0.57	1%	0.22	1%	0.44	1%
Management and supervision costs	0.58	1%	0.03	0%	0.01	0%	0.17	0%
Sub-total	6.08	13%	2.32	5%	2.01	6%	3.25	7%
Total	**48.28**	**100%**	**47.51**	**100%**	**36.07**	**100%**	**45.38**	**100%**

[11] Exchange rate US$1 = Tsh 1469 (2010).

A comparison of the expense categories highlights some differences between the sites in the three regions during non-campaign service delivery. Personnel costs account for the single biggest contribution to the unit costs in all three provinces—about 38 percent of the total costs in Iringa and Mbeya and 34 percent in Kagera. Personnel costs per VMMC are significantly higher in Iringa and Mbeya ($18.57 and $18.06) compared with Kagera ($12.16). This is attributable to overtime allowances paid to VMMC service providers in Iringa and Mbeya for after-hours work and fixed government scale salaries for Kagera service providers.

Consumables include drugs and supplies, while non-consumable supplies include items such as surgical gowns, sterile drapes, and surgical equipment used during pre- and post-circumcision. Consumable costs account for 23 percent, 35 percent, and 47 percent in Iringa, Mbeya, and Kagera, respectively, and are the second biggest contributor to the total unit cost.

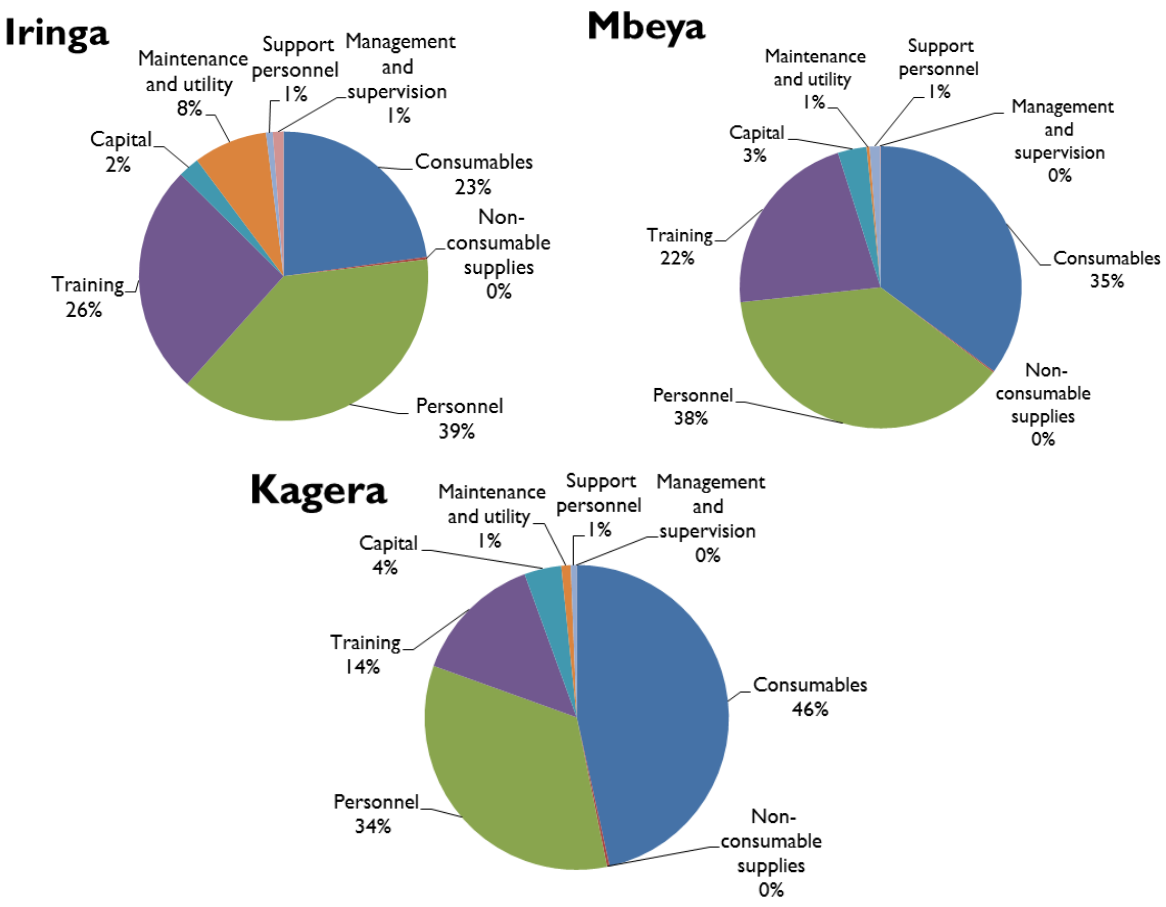
Average unit costs for non-campaign sites in Tanzania

As we see above in Table 6, the unit costs for Tanzania are derived by averaging the unit costs of the three regions (weighted according to number of VMMC performed). The average unit cost is estimated at $45.38 for non-campaign sites in Tanzania.

Key drivers of unit cost in non-campaign sites

An analysis of the key inputs for all three regions shows that personnel costs constitute the main expense, followed by costs for training and consumables (see Figure 3).

Figure 3. Analysis of key cost drivers in non-campaign service delivery



There is a substantial difference in maintenance and utility costs among the three regions. These costs are relatively higher in Iringa ($3.99) than in Mbeya and Kagera ($0.16 and $0.36, respectively) (see Table 6). Thus, indirect costs are divided between the total numbers of health clients. It is worth noting that capital equipment costs are relatively small for all three provinces, as these are annualized over their useful lives and are spread over the total number of VMMC.

Although the protocol was modified to include the collection of information on waste management, this information was not available at the sites or in the MSD and thus was excluded from the calculation of unit costs. The costs of supply chain management and logistics are included in the individual cost of commodities and supplies, as obtained from the implementing partners.

Table 7 summarizes the unit costs for VMMC performed under the campaign service delivery model in Iringa and Kagera. Mbeya did not conduct VMMC campaigns during the study period. In Iringa, two campaigns were completed—one during June/July 2010 and another during December 2010, with a total of 12,923 VMMC performed. The Kagera campaign was done in March 2010 and a total of 214 VMMC were performed. In Iringa, the number of VMMC completed during the campaigns is quite high because of a combination of factors: (1) strong support from the local leadership; (2) an effective mobilization strategy (meetings with key stakeholders at regional and district levels to create local ownership of the campaign); (3) a supportive VMMC task force (comprising technical and demand-creation committees at regional and district levels) to oversee the planning and implementation of the campaigns; and (4) the training of additional providers, including 45 surgeons (medical officers, clinical officers, and nurses) and 20 VMMC counselors (PITC- or VCT-trained counselors).

Table 7. Overview of VMMC unit costs at campaign sites

	Iringa Province		Kagera Hospital		Tanzania Average	
Number of MCs/yr	12,923		214		13,137	
	Cost (US$)	**%**	**Cost (US$)**	**%**	**Cost (US$)**	**%**
Direct costs						
Consumables costs	11.00	24%	16.70	18%	11.09	24%
Non-consumable supplies costs	0.13	0%	0.10	0%	0.13	0%
Personnel costs	20.72	46%	10.80	12%	20.56	45%
Training costs	4.79	11%	62.42	67%	5.73	12%
Sub-total	*36.64*	*81%*	*90.01*	*97%*	37.51	82%
Indirect costs						
Capital costs	1.64	4%	2.66	3%	1.66	4%
Maintenance and utility costs	3.99	9%	0.17	0%	3.93	9%
Support personnel costs	1.98	4%	0.18	0%	1.95	4%
Management and supervision costs	0.95	2%	0.01	0%	0.93	2%
Sub-total	*8.57*	*19%*	*3.03*	*3%*	8.48	18%
Total	**45.21**	**100%**	**93.05**	**100%**	**45.98**	**100%**

The weighted average cost per VMMC performed was $45.21 in Iringa and $93.05 in Kagera. Personnel costs account for the largest share (46%) of the unit cost in Iringa, while training costs account for the largest expense (67%) in Kagera. The high cost of personnel in Iringa is largely attributable to the overtime paid to VMMC providers and the large number of VMMC personnel involved in service provision during the campaign period. The high unit cost in Kagera is mainly attributable to the cost being spread over a small number of VMMC performed during the campaign period (only 214 circumcisions were performed at Kagera Hospital). In Kagera, the training costs are also high because a large number of VMMC staff underwent the training relative to the actual number of VMMC performed during the campaign period. For instance, a total 24 VMMCs providers (3 doctors, 13 nurses, and 8 counselors) were trained on VMMC service provision at a cost of $13,357.

Overall, direct costs account for 81 percent and 97 percent of the total cost per VMMC performed in Iringa and Kagera, respectively. The indirect costs, which include capital costs, account for 8.6 percent of total costs in Iringa and 3 percent of the total costs in Kagera. During the campaign, all the VMMC were performed in non-campaign facilities. The main difference between the non-campaign service delivery and campaign sites is that VMMC facilities were outfitted with between four and six bays to handle a higher volume of clients in the campaign sites.

Maintenance and utility costs account for about 4 percent in Iringa and less than 1 percent in Kagera. Maintenance costs include expenses for renovating new sites for VMMC provision, as well as emergency vehicle maintenance. Utilities included fuel consumption, transport costs, and electricity costs. In Kagera, the costs are lower because the share of VMMC to the facility workload was quite small due to the small number of VMMC performed in March 2010.

It is interesting to note that capital equipment costs contribute relatively little to the unit costs (1% in the non-campaign model) these costs were annualized over their useful lives and, in turn, were spread over a relatively high number of VMMCs.

Average unit costs at campaign sites in Tanzania

The overall unit cost for campaign sites in Tanzania is derived by taking the weighted average of the unit costs for the two regions, with weighting determined by the number of VMMCs performed). The average unit cost is estimated at $45.98 for all campaign sites in Tanzania, as shown in Table 7, above.

Key drivers of unit cost for campaign sites

An analysis of the key inputs for the two regions shows that unlike the non-campaign service delivery models, personnel costs are not consistently the main expense in the campaign service delivery model. At the sites in Kagera, training costs account for the biggest expense. Consumables also feature as one of the highest expenses (see Figure 4).

Table 8 provides a snapshot of the key drivers of unit costs in both non-campaign and campaign sites.

Figure 4. Key cost drivers in the campaign model

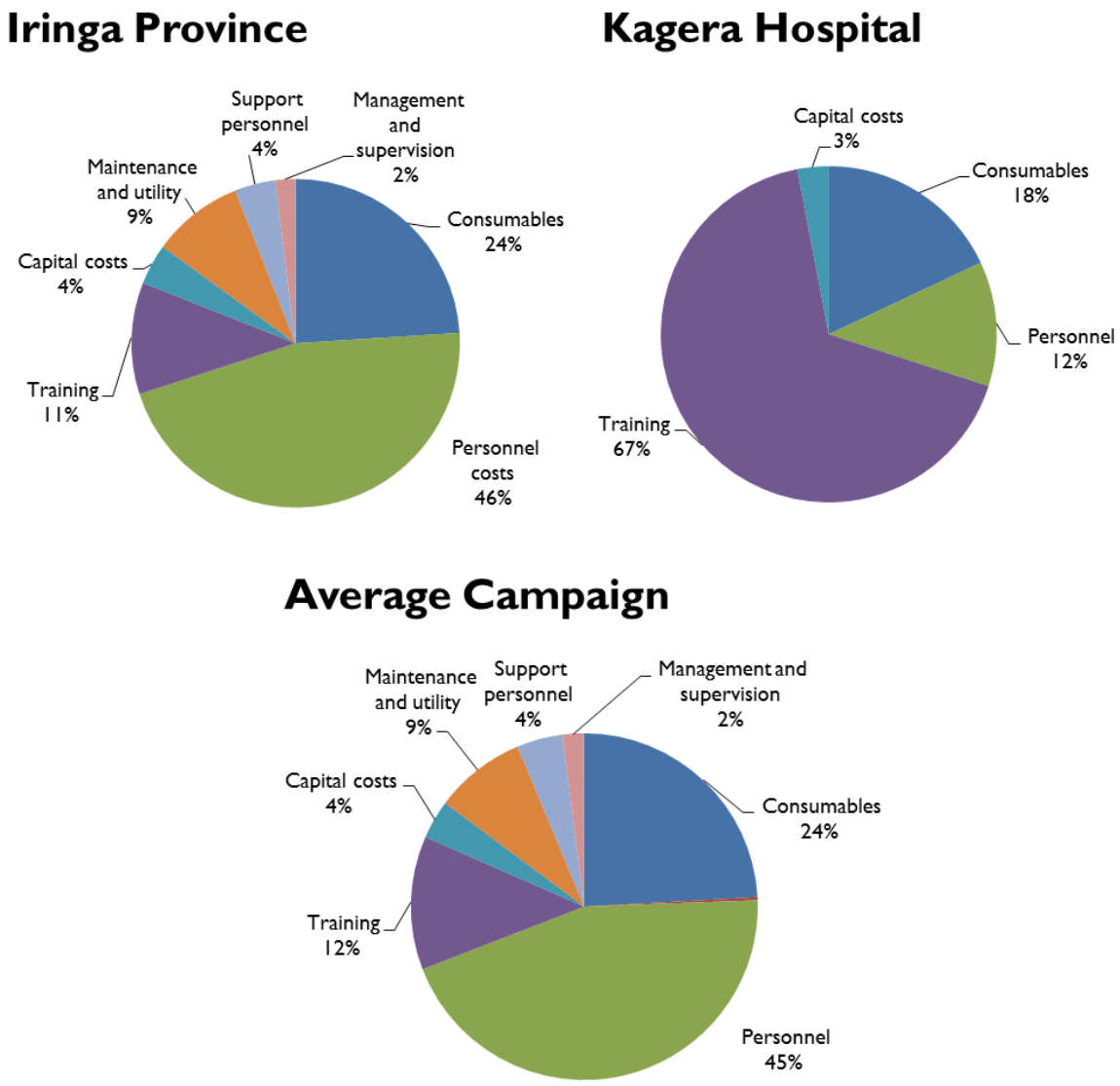


Table 8. Snapshot—key drivers of unit costs

Fixed Sites	
Non-Campaign	**Campaign**
Personnel costs (39%, Iringa, Mbeya)	Personnel costs (46% Iringa)
Consumables (46% Kagera)	Training costs (67% Kagera)

3.2. Cost per VMMC Performed at Island Outreach Sites (Goziba Islands in Kagera Region)

We calculated the costs of performing VMMC in island outreach sites separately, as the costs to reach island sites (unique to Kagera Province) are significantly higher than non-campaign or campaign sites. For example, the costs of the programs on Goziba Island included boat rentals, which were required to reach individuals on these islands.

Table 9 presents the breakdown of direct and indirect costs for VMMC provision in the Goziba Islands in Lake Victoria. These are hard to reach and there are no health facilities on the islands. Staff is drawn from the Kagera Regional Hospital provide VMMC services. The islands are only reachable by boat, and once there, the staff performs VMMC in tents specifically procured for VMMC services. The unit cost per VMMC was found to be high at $128.60. This is attributable to high indirect costs, which account for the largest share of the unit cost (64%).

Table 9. VMMC unit costs for island outreach service delivery—Goziba Islands in Kagera

Number of MCs Performed	**415**	
Direct costs		% of total unit cost
Consumables costs	16.87	13%
Non-consumable supplies costs	0.10	0%
Personnel costs	14.80	12%
Training costs	14.28	11%
Subtotal	*46.05*	36%
Indirect costs		% of total unit cost
Capital costs	39.74	31%
Maintenance and utility costs	38.38	30%
Support personnel costs	4.32	3%
Management and supervision costs	0.11	0%
Subtotal	*82.55*	64%
TOTAL	**128.60**	**100%**

Overall, the cost per VMMC is high at $128.60 relative to the costs for non-campaign (both during campaign and outside of campaign). This is largely due to the following:

1. The high cost of tents procured specifically for VMMC services in the islands. The large tent, fully equipped with VMMC bays and other inputs used in performing VMMC, costs $40,000 each. A smaller tent is slightly cheaper at about $20,000 per tent.

2. The number of VMMC performed is relatively small, thus, costs are spread over a smaller number of procedures. We assume that the unit cost will go down as VMMC is offered to more men.
3. Maintenance and utilities costs are high because of the cost of hiring two boats: one for the transportation of drugs and supplies and another for staff.

3.3. Impact of Scaling Up Voluntary Medical Male Circumcision in Tanzania

Model assumptions

The following key assumptions were used in the impact model. For a detailed description of these assumptions, see Appendix 1.

HIV prevalence rates and epidemiological assumptions

Trends in HIV prevalence in Tanzania were obtained from Spectrum data, which were last updated in March 2010. Further details on HIV prevalence by gender and age group were derived from the Tanzania AIDS and Malaria Indicator Survey 2007–2008.

By modeling historical data on HIV prevalence from the onset of the HIV epidemic in 1985, the DMPPT is able to project prevalence estimates up to 2015. The data show that the estimated HIV prevalence rate rose steadily, peaking at 6.83 percent in 1997, and then declined to 4.53 percent in 2010. It is projected to decline further to 3.73 percent by 2015.

Effectiveness

Effectiveness is defined as the number of HIV infections averted. The model assumes a 60 percent reduction in risk of infection for a circumcised man engaging in unprotected sex with an HIV-positive woman. The model also assumes that circumcision is not effective in reducing male-to-female transmission and that it would not cause an increase in risk compensation (increased risk taking as a result of being circumcised).[12] Although circumcision offers direct benefits to only circumcised men, women and uncircumcised men accrue indirect benefits (Kahn et al., 2006; Auvert et al., 2005; Hallett et al., 2008; Williams et al., 2006; and Njeuhmeli et al, 2011) since HIV prevalence will decline eventually, thus reducing risk of infection for both men and women.

Economics

The DMPPT discounts all costs and benefits of male circumcision and uses a discount rate of 3 percent per annum. Therefore, the discounted costs and benefits do not represent the actual cash flow in each period but rather a measure of economic value. To calculate the discounted benefit of an infection averted, a discounted lifetime cost of antiretroviral therapy was assumed to be $7,400.

The model also estimated an annual demand-creation cost of $862,917 per annum. This amount is based on a budget analysis prepared by MOHSW/NACP for the eight regions earmarked for VMMC scale-up in Tanzania. While some service providers have actual expenditures on demand creation in the regions they support, information on planned expenditures based on populations to be reached and regional differences on a yearly basis are hard to come by (e.g., would costs for demand creation need to increase or decrease

[12] DMPPT allows the user to analyze various assumptions about risk compensation. As an initial assumption, it was assumed that there would not be any increased risk taking behavior as a result of male circumcision.

over time). The model therefore assumes that the demand-creation cost shown above would be evenly spent over five years.

3.4. Total Number of Male Circumcisions

Figure 5 and Table 10 present the number of circumcisions that would need to be performed to scale-up coverage of VMMC to 87.1 percent of HIV-negative males between ages 15 and 49 by 2015. It shows the number of circumcisions performed each year for the base scenario, where the current rate of circumcision prevalence (66.8%) is increased to reach the target of 87.1 percent of males between the ages of 15 and 49 by 2015. This trajectory results in a large increase in the number of circumcisions required per year in the short term, rising from 410,000 in 2010 and peaking at almost 1.3 million circumcisions in 2013 and dropping to about 480,000 circumcisions annually from 2016 to 2030 (see Table 10).

Figure 5. Number of VMMCs performed to achieve 87.1% coverage

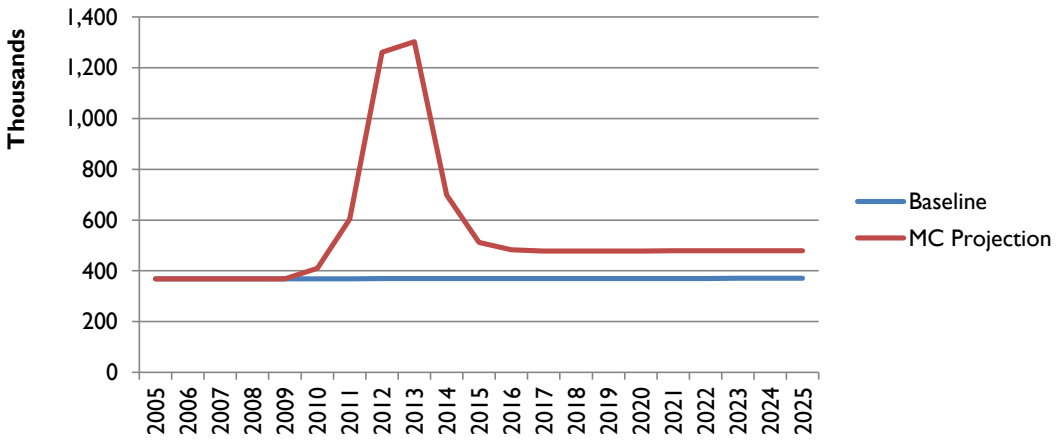


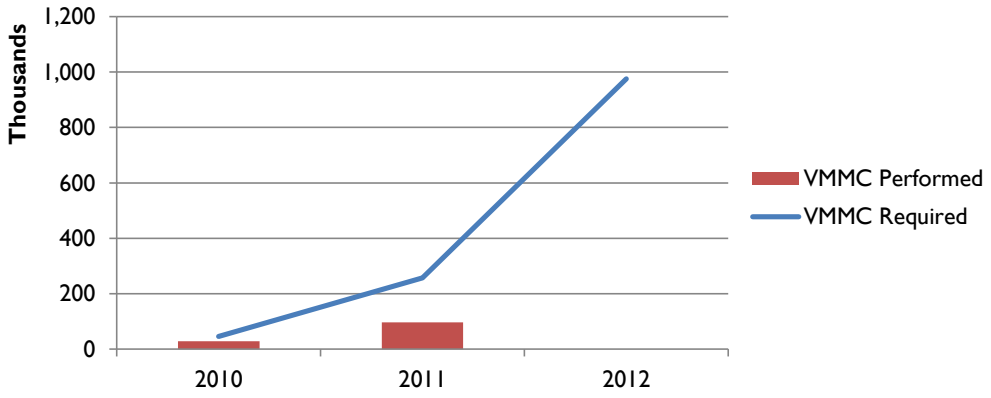
Table 10. Number of circumcisions at 87.1% coverage

Year	Base Projection	MC Projection	Difference
2010	368,798	410,262	41,464
2011	368,907	604,345	235,438
2012	369,016	1,260,918	891,902
2013	369,126	1,302,771	933,646
2014	369,235	698,381	329,146
2015	369,344	511,396	142,052
2016	369,453	482,331	112,877
2017	369,563	478,493	108,931
2018	369,672	478,154	108,482

Year	Base Projection	MC Projection	Difference
2019	369,782	478,292	108,510
2020	369,891	478,493	108,602
2021	370,001	478,703	108,702
2022	370,110	478,912	108,802
2023	370,220	479,123	108,903
2024	370,329	479,333	109,003
2025	370,439	479,508	109,069
2010–2015	2,214,426	4,788,073	2,573,648
2016–2025	3,699,459	4,791,342	1,091,883

Figure 6 illustrates Tanzania's progress to date, relative to the number of VMMC required to achieve its target. In 2011, the actual number of circumcisions was only 40 percent of the national target. In 2012, it is projected that Tanzania will need to circumcise close to one million males, which represents a ten-fold increase from what was achieved in 2011.

Figure 6. Comparison of progress toward achieving targets—Tanzania



3.5. Impact of VMMC Scale-Up on HIV Infection

Figure 7 and Table 11 show the projected impact of VMMC scale-up on the number of new adult HIV infections. Scaling up adult VMMC to reach 87.1 percent coverage by 2015 would result in averting almost 28,000 new HIV infections through 2015. The results also indicate that the annual number of new infections in the 87.1 percent scale-up scenario declines from 84,000 in 2010 to 64,000 by 2025. Overall, between 2010 and 2025, a cumulative total of about 196,560 HIV infections, or 14.5 percent of total new HIV infections, are averted as a result of the VMMC scale-up. HIV infections decline marginally from 2010–2013, and thereafter, the pace of reduction is faster, illustrating the long-term positive effect of scaling up VMMC. With no VMMC scale-up, the annual number of new infections will rise from 83,742 in 2010 to 85,532 by 2025.

Figure 7. Number of new adult HIV infections (87.1% coverage)

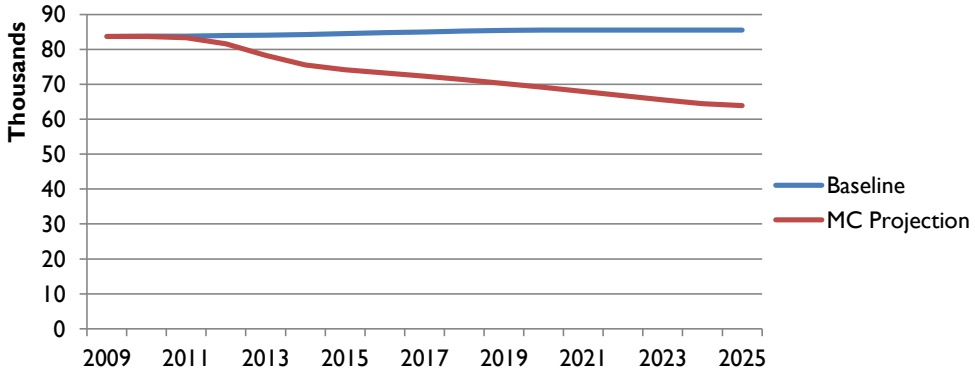


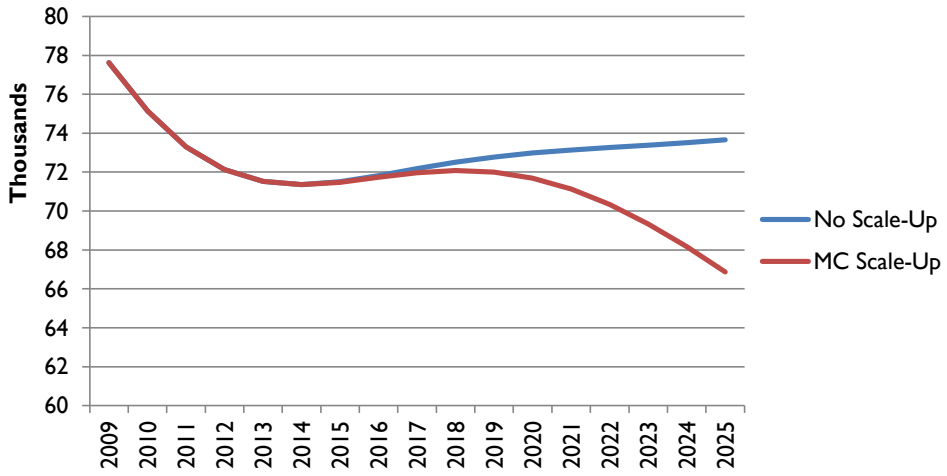
Table 11. Number of infections and infections averted (87.1% coverage)

	2010	2011	2012	2013	2014	2015	2016	2017
Base	83,742	83,807	83,913	84,070	84,272	84,508	84,758	85,001
MC scale-up	83,685	83,328	81,604	78,283	75,529	74,194	73,248	72,314
Infections averted	57	479	2,309	5,786	8,743	10,314	11,510	12,687
	2018	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
Base	85,215	85,384	85,498	85,551	85,548	85,533	85,528	85,532
MC scale-up	71,320	70,251	69,113	67,923	66,707	65,522	64,403	63,875
Infections averted	13,895	15,133	16,385	17,628	18,841	20,011	21,124	21,657

3.6. Impact of VMMC Scale-Up on Annual AIDS-Related Deaths

Figure 8 shows the projected impact of scaling up VMMC to 87.1 percent on the annual cumulative number of AIDS-related deaths. The results indicate that male circumcision could avert almost 24,000 deaths between 2010 and 2025. The reductions in annual deaths with no VMMC scale-up are far fewer. In both cases, the projected impact of VMMC on AIDS-related deaths is small until 2013. Thus, the intervention may not lead to fewer AIDS-related deaths in the short term, but in the longer term, a reduction of comparable magnitude is achieved.

Figure 8. Annual number of AIDS-related deaths



The HIV prevalence with VMMC scale-up decreases from 3.92 percent in 2010 to 3.11 percent by 2025. The prevalence among men drops from 3.3 percent (no VMMC scale-up) to 2.58 percent (87.1% scale-up). There is also significant reduction in the prevalence among women as a result of male circumcision. Female prevalence for HIV is projected to decrease from 4.53 percent in 2010 to 3.64 percent in 2025 with 87.1 percent scale-up.

3.7. Impact on the Rate of New HIV Infections by Age and Sex

Figure 9 and Table 12 show the projected impact of VMMC scale-up on the number of new infections among women and men. The cumulative impact on both males and females of VMMC scale-up from 2010 to 2025 is shown in the age groups 15 to 49 for both men and women. With VMMC scale-up, the number of new HIV infections for men ages 15 to 49 years is expected to drop by almost half from 38,233 in 2010 to 28,983 in 2025. With no scale-up, the number of infections for men ages 15 to 49 years is expected to rise from 38,233 in 2010 to 40,727. The number of new HIV infections for women during the same time period is expected to decrease from about 45,452 in 2010 to 34,892 in 2025 with VMMC scale-up. It is evident from these results that VMMC scale-up is projected to significantly reduce new infections.

Although there are currently no known direct benefits of VMMC for women, available data suggest that there are important indirect health benefits, particularly a reduced risk of exposure to HIV and other sexually transmitted infections through the reduction in HIV infection among men. Lower HIV incidence due to high prevalence of male circumcision means that the likelihood of women encountering an HIV-positive male sexual partner will gradually decline. Therefore, scaling up the VMMC program in Tanzania could result in significant gains for HIV prevention for both men (directly) and women (indirectly).

Figure 9. New adult HIV infections averted by age and sex

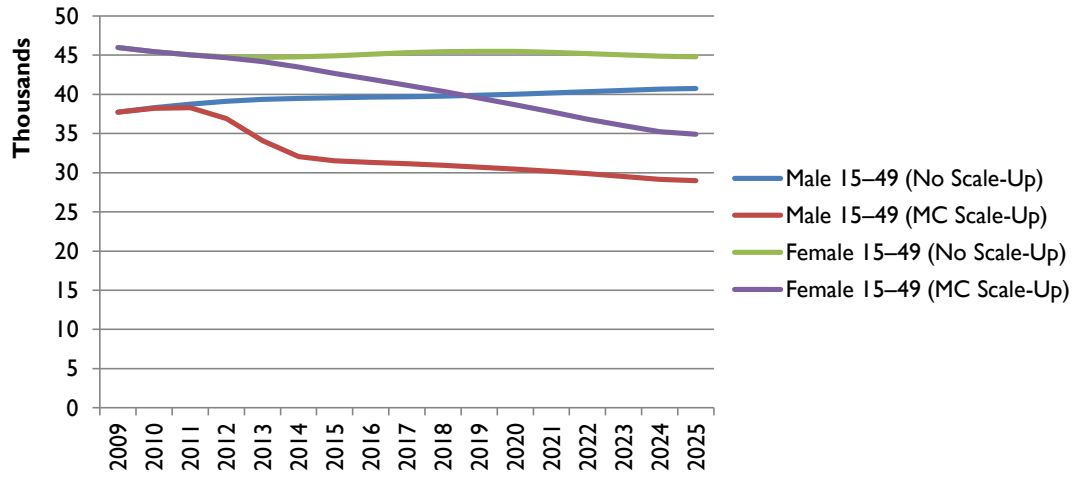


Table 12. New adult HIV infections averted by age and sex (in thousands)

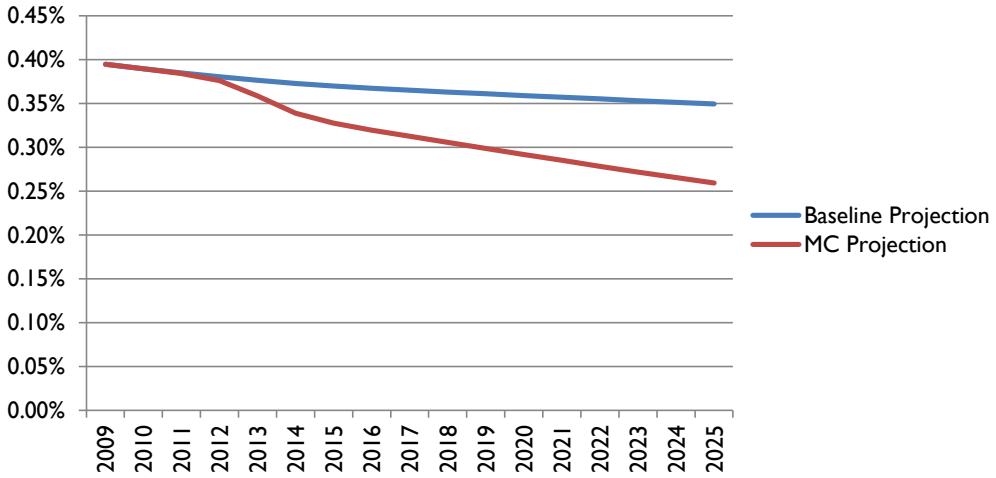
	Male 15–49 (No Scale-Up)	Male 15–49 (MC Scale-Up)	Female 15–49 (No Scale-Up)	Female 15–49 (MC Scale-Up)
2009	37,726	37,726	45,968	45,968
2010	38,289	38,233	45,453	45,452
2011	38,755	38,293	45,052	45,035
2012	39,105	36,918	44,809	44,686
2013	39,344	34,094	44,726	44,190
2014	39,492	32,065	44,780	43,465

	Male 15–49 (No Scale-Up)	Male 15–49 (MC Scale-Up)	Female 15–49 (No Scale-Up)	Female 15–49 (MC Scale-Up)
2015	39,580	31,517	44,928	42,677
2016	39,640	31,335	45,118	41,913
2017	39,699	31,161	45,302	41,153
2018	39,779	30,954	45,436	40,366
2019	39,888	30,719	45,496	39,532
2020	40,028	30,459	45,470	38,653
2021	40,187	30,176	45,364	37,747
2022	40,352	29,866	45,196	36,842
2023	40,512	29,529	45,021	35,994
2024	40,660	29,169	44,868	35,234
2025	40,727	28,983	44,805	34,892

3.8. Impact of Male Circumcision on Incidence of HIV Infection

Available data from randomized controlled trials indicate that male circumcision has the potential to reduce HIV incidence for women and uncircumcised men, as well as for those circumcised (Hallett et al., 2008; Njeuhmeli et al, 2011). When VMMC is scaled up, the incidence of HIV will drop from 0.39 percent in 2010 to 0.26 percent in 2025. Without VMMC scale-up, HIV incidence will decrease marginally from 0.39 percent in 2010 to 0.35 (see Figure 10 and Table 13). These results clearly show that higher VMMC prevalence has the potential to significantly lower HIV incidence and provide a cost-effective prevention strategy.

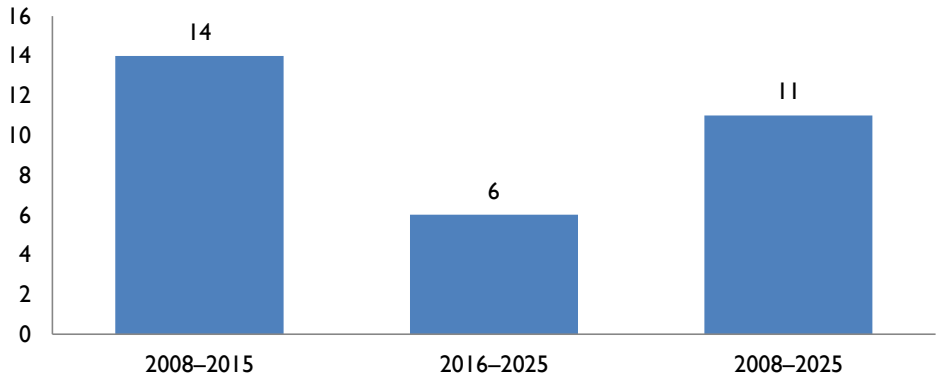
Figure 10. Adult incidence of HIV



3.9. Number of VMMC per Infection Averted

Figure 11 presents the number of VMMC required to avert one HIV infection. The number of circumcisions per infection averted is calculated by dividing the number of new VMMC performed by the projected number of HIV infections averted over a given time period. The results show that between 2008 and 2015, about 14 male circumcisions would be required to avert one HIV infection. However, as the impact of male circumcision increases over time, the number of additional circumcisions needed to avert one HIV infection reaches a low of about 6.5 circumcisions between 2016 and 2025. Overall the analysis indicates that there will be one HIV infection averted for every 11 circumcisions performed. Once again, greater commitment of resources up front means greater gains for fewer resources later.

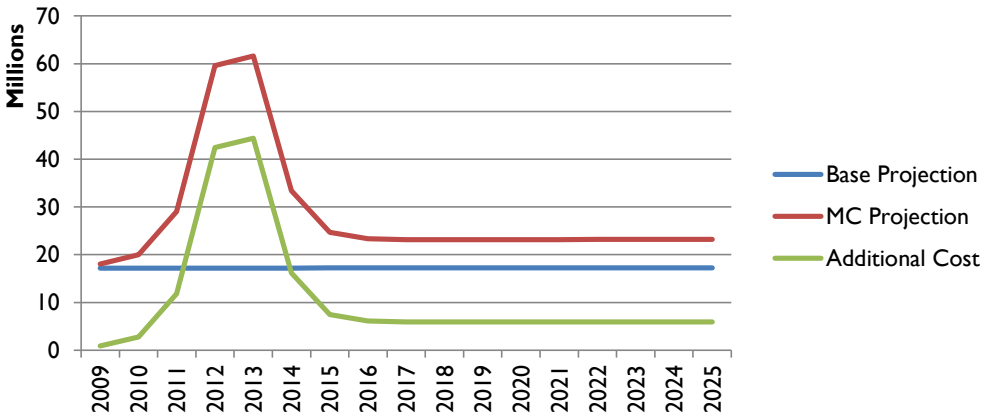
Figure 11. Number of VMMC per infection averted



3.10. Cost Implications of Scaling Up VMMC

The cost of scaling up VMMC in the eight regions increases rapidly over the short term, peaking at $61.5 million in 2013 (see Figure 12). After the initial intensive scale-up of services through 2015, total annual costs decline to about $23 million in the long term. Between 2010 and 2015, the total additional investment required to achieve the targeted number of VMMC is estimated at $125.1 million, while $59.5 million would be required from 2015 to 2025.

Figure 12. Additional cost of scaling up VMMC in Tanzania (US$)



3.11. Regional Analysis—Cost Implications of Scaling Up VMMC

Scaling up adult VMMC to reach 80 percent of men between ages 15 and 49 in regions where current coverage is less than 80 percent (pushing the overall national coverage to 87.1 percent coverage by 2015)[13] would necessitate around 2.8 million VMMCs at an additional cost of $134 million through 2025[14] (see Table 14).

Table 14. Regional targets and additional cost of scaling up VMMC

	Target VMMC 2010–2015	Target VMMC 2016–2025	Total target VMMC	Cost to reach target 2010–2015	Cost to reach target 2016–2025	Total Costs to reach targets
Iringa	178,899	73,113	252,012	8,339,286	8,339,286	16,678,571
Kagera	351,707	142,752	494,459	16,394,628	6,654,300	23,048,928
Mbeya	287,424	116,774	404,198	13,398,116	5,443,350	18,841,466
Mara	26,105	8,461	34,566	1,216,848	394,410	1,611,258
Mwanza	252,338	99,875	352,213	11,762,602	4,655,631	16,418,233
Rukwa	183,036	83,812	266,848	8,532,124	3,452,290	11,984,414
Shinyanga	481,163	195,934	677,097	22,429,147	9,133,370	31,562,517
Tabora	207,218	84,980	292,198	9,659,354	3,961,294	13,620,648
Total			**2,773,592**			**$133,766,035**

3.12. Net Cost Savings and Cumulative Net Cost Savings per Adult HIV Infection Averted

The discounted net costs per adult HIV infection averted are the cumulative net costs of the scaled-up VMMC program, divided by the cumulative number of adult HIV infections averted over the relevant timeframe (both of which are discounted). In addition, net cost savings is the difference between the benefits of averting an HIV infection (the discounted lifetime ARV treatment costs avoided) and the costs (resources required to perform enough circumcisions to avert an HIV infection).

The discounted cost of averting an HIV infection for the time period 2010–2015 is $4,700, while discounting the costs over the entire period of 2010–2025 results in a much lower discounted cost of $1,100 per HIV infection averted. The net discounted savings for the period 2010–2015 amounts to $2,700, while the total discounted savings from 2010–2025 are much higher at $6,300. Thus, net savings associated with preventing an HIV infection through VMMC are quite substantial, while the financial cost of averting an HIV infection is small when compared to the financial benefit.

[13] The national coverage estimate of 87.1% is based on estimates that the 8 targeted regions would reach an 80% coverage level and the 13 non-targeted regions would retain their current levels of coverage.

4. DISCUSSION AND CONCLUSION

The results from the unit costing workbook indicate that the weighted average cost of performing VMMC during non-campaign service delivery model in the three regions is $45.38. These costs are consistent with values reported for non-campaign service delivery model from VMMC costing studies in Kenya, Uganda, Zambia, and South Africa, which range from $31.84 in Kenya to $100.07 in Zimbabwe.

The results also indicate that personnel costs account for the single biggest contribution to the unit costs in all three provinces—about 38 percent of the total costs in Iringa and Mbeya and 34 percent in Kagera. Personnel costs per circumcision are significantly higher in Iringa and Mbeya ($18.57 and $18.06) compared with Kagera ($12.16). This is attributable to overtime allowances paid to VMMC service providers in Iringa and Mbeya for after-hours work and fixed government scale salaries for Kagera service providers.

The findings further show that the average unit cost per VMMC performed for a campaign service delivery model ($45.98) is comparable to that of non-campaign models. The unit cost varies widely, ranging from $45.21 in Iringa to $93.05 in Kagera. The main direct cost drivers of the two models combined are personnel costs 45 percent) and consumables (24%). The unit cost in Kagera is high largely because the cost is spread over a small number of circumcisions. The number of VMMC performed in Kagera is low because there was only one campaign in 2010, during which 214 VMMC were performed. In Iringa, unit cost is low because the number of VMMC completed during campaigns is quite high due to a combination of factors: (1) strong support from the local leadership; (2) an effective mobilization strategy (meetings with key stakeholders at regional and district levels to create local ownership of the campaign); (3) support of an VMMC task force (including technical and demand-creation committees at regional and district levels) to oversee the planning and implementation of the campaigns; and (4) the training of additional providers.

The unit cost per VMMC for the island outreach service delivery model is high at $128.60 in the Goziba Islands. The main reason for this is because gaining access to the islands on Lake Victoria is expensive. The related costs include the hiring of boats for transporting the service providers and equipment.

The results indicate that scaling up adult VMMC to reach 87.1 percent would avert 28,000 new HIV infections through 2015. The annual number of new infections declines from 84,000 in 2010 to 64,000 by 2025. The number of new HIV infections declines marginally between 2010 and 2013 and accelerates thereafter, a manifestation of rapid scale-up of the VMMC program, and continues through 2025, illustrating the long-term positive impact of scaling up VMMC. With no VMMC scale-up, the annual number of new infections will rise from 84,000 in 2010 to 86,000 by 2025.

The results further show that VMMC scale-up will require an additional cost of $125.1 million through 2015 and $59.5 million between 2016 and 2025. This would result in an average cost per HIV infection averted of $4,700 during 2010–2015 and $1,100during 2010–2025. The results also indicate that increasing the prevalence of male circumcision from current levels to 87.1 percent by 2015 would increase the discounted net savings per infection averted from $2,700 through 2015 to $6,300 during the 2010–2025 time period.

This analysis makes it clear that VMMC could have an immediate impact on HIV transmission, but the full impact on prevalence and deaths will only be apparent in the long term—about 10–15 years later. The findings have also shown that scaling up VMMC will have a significant effect on the incidence of HIV. The results, which are similar to findings from related studies, show that with 87.1 percent circumcision prevalence, HIV incidence would fall significantly from 0.39 percent in 2010 to 0.26 percent by 2025.

While the results indicate that scaling up VMMC coverage to 87.1 percent by 2015 would significantly reduce the number of new HIV infections, this would require increasing the annual number of circumcision procedures to about 1.3 million in 2013 before leveling off to about 480,000 after 2015.

In addition, scaling up VMMC to reach the target of 87.1 percent by 2015 requires a rapid increase in the number of circumcisions performed during 2010–2013. This is largely due to intensified efforts to provide VMMC services to the existing cohort of uncircumcised men in the country.

4.1. Study Limitations

Some limitations of this study are worth noting:

- The unit cost does not include the cost of personnel seconded by implementation partners to monitor and supervise the implementation of VMMC services and the management costs incurred by the partners despite overseeing the overall implementation of the VMMC services for the same reason—these costs are calculated from the perspective of the government as the implementer.
- This analysis only considered the impact of VMMC on reducing HIV transmission and the number of HIV infections averted. It is, however, increasingly being realized that the scaling up of VMMC offers an opportunity to improve the delivery of male reproductive health services. A similar analysis of the costs and benefits of VMMC within the context of a comprehensive package of male reproductive health services might be useful.
- In Tanzania, a large proportion of clientele seeking campaign services are 10–24 year olds. As a result, coverage has been lower among those men over the age of 30. However, the model assumes constant coverage across all age groups.
- The activity targeted males aged 15–49 years as a priority population group for VMMC and excluded early infant circumcision in the analysis since this program does not exist.
- The DMPPT impact model calculated trends in HIV prevalence for the country as a whole and did not make estimates that were specific to any individual region. This was because the reliability of prevalence estimates at the regional level was much more uncertain. However, since the scale-up of circumcision in the country is occurring in targeted regions, the actual impact of VMMC may be either underestimated or overestimated, depending on the actual trends in individual regions.
- The report uses the global default value for lifetime discounted ART costs ($7,500), because Tanzania-specific information is lacking. If Tanzania pays less for treatment than this global default indicates, the financial savings associated with male circumcision would be less due to an overestimation of treatment costs. Conversely, if the lifetime cost of treatment is higher in Tanzania than this global value suggests, the savings could be higher than indicated in this paper.
- In calculating the unit cost of VMMC, this study did not conduct a time-motion analysis of human resource use at the facility level. Instead reported labor time required to perform the surgery was collected from interviews with those performing the operation. Thus, the actual unit costs could vary from what is calculated here, depending on whether the time estimates were overestimated or underestimated.
- Although the protocol was modified to include the collection of information on waste management, this information was not available at the sites or in the MSD and thus was excluded from the calculation of unit costs.

- As already indicated, this analysis collected unit cost estimates at the health facility level. Thus this analysis did not include estimates of the costs incurred by patients as they obtain transportation to the facility and incurred lost labor costs associated with the procedure.
- In addition, since this analysis only accounted for expenditures on VMMC, it did not include the cost or impact of traditional circumcision practices.
- The future allocation of circumcisions in campaign, non-campaign and island outreach sites is uncertain. However, since the unit cost at campaign sites ($45.98) is comparable to that of non-campaign sites ($45.38), the actual distribution of circumcisions will only minimally affect the total resources required.

4.2. Recommendations

Based on the findings above, developing a population- and access-based detailed implementation plan for scale-up of the VMMC program in Tanzania is essential, especially as there are service sites where demand is high and the wait list is long. In the non-campaign sites, provision of VMMC services is on a part-time basis. All personnel involved in the provision of services are full-time employees in government health facilities and work on VMMC service provision for limited hours. If the demand for VMMC services is to be met within the short-term period (catch-up period lasting 5 years), full time staff assignment is essential. Staff retention for continuous provision of services is also essential. For instance, the issue of overtime for staff providing VMMC services beyond their normal working hours needs to be revisited and, if possible, harmonized in all the regions regardless of the partner supporting VMMC services. Demand creation is also critical to ensure the success of VMMC. In view of this, there is a need for the MOHSW/NACP to develop a coherent strategy and implementation plan for demand creation. Finally, mobilizing resources for VMMC (by MOHSW and development partners) is critical to program success.

APPENDIX 1: AMORTIZATION ASSUMPTIONS FOR CAPITAL GOODS

#	Item	Amortization Period (Years)	Justification	Source
1.	Diathermy machine	5	Comparable item—Examination, surgery equipment	DMPPT default
2.	Diathermy pencil	5	Comparable item—Examination, surgery equipment	DMPPT default
3.	Diathermy plate	5	Comparable item—Examination, surgery equipment	DMPPT default
4.	Foot pedals	5	Comparable item—Examination, surgery equipment	DMPPT default
5.	Hand piece	5	Comparable item—Examination, surgery equipment	DMPPT default
6.	Hand piece (neutral electrode) and or plate	5	Comparable item—Examination, surgery equipment	DMPPT default
7.	Generator and incinerator	10	Comparable country—Kenya	(Changed model default of 7 years) WHO CHOICE database http://www.who.int/choice/costs/prices_t4/en/index.html
8.	AC unit for surgical marquees	9.3	Comparable item—AC	WHO CHOICE database http://www.who.int/choice/costs/prices_t1/en/index.html
9.	Refrigerators, coolers	10	Comparable country—Kenya	(Changed 7 year default in the model) WHO CHOICE database http://www.who.int/choice/costs/prices_t4/en/index.html
10.	Bed blocks	7	Comparable item—Beds	DMPPT default
11.	Operating stool	8	Comparable item—Chairs in Kenya	WHO CHOICE database http://www.who.int/choice/costs/prices_t4/en/index.html
12.	Operating table	8	Comparable item—Chairs in Kenya	WHO CHOICE database http://www.who.int/choice/costs/prices_t4/en/index.html
13.	Recovery chair	8	Comparable item—Chairs in Kenya	WHO CHOICE database http://www.who.int/choice/costs/prices_t4/en/index.html

#	Item	Amortization Period (Years)	Justification	Source
14.	Wooden spine board (instead of patient trolley)	8	Comparable item—Chairs in Kenya	WHO CHOICE database http://www.who.int/choice/costs/prices_t4/en/index.html
15.	Step ladder	8	Comparable item—Chairs in Kenya	WHO CHOICE database http://www.who.int/choice/costs/prices_t4/en/index.html
16.	Trolley (emergency crash cart	8	Comparable item—Chairs in Kenya	WHO CHOICE database http://www.who.int/choice/costs/prices_t4/en/index.html
17.	Office furniture	8	Comparable item—Chairs in Kenya	(Changed model default of 7 years) WHO CHOICE database http://www.who.int/choice/costs/prices_t4/en/index.html
18.	Pump, suction, mechanical, twin pump	5	Comparable item—Examination, surgery equipment	DMPPT default
19.	Stand, infusion, 2 hooks, on castors	5	Comparable item—Examination, surgery equipment	DMPPT default
20.	Penis models	5	Comparable item—Examination, surgery equipment	DMPPT default
21.	Centrifuge, automatic	7	Comparable item—Laboratory equipment	DMPPT default
22.	Pressure cooker sterilizer	7	Comparable item—Laboratory equipment	DMPPT default
23.	Instrument brush	5	Comparable item—Laboratory equipment	DMPPT default
24.	Lockable steel cabinets	10	Comparable item—cupboards in Kenya	WHO CHOICE database http://www.who.int/choice/costs/prices_t4/en/index.html
25.	Fire extinguisher	5	Fire protection equipment	IRS http://www.irs.gov/businesses/article/0,,id=159973,00.html
26.	Standing lamp	10	Comparable item—Voltage stabilizers	WHO CHOICE database http://www.who.int/choice/costs/prices_t4/en/index.html

#	Item	Amortization Period (Years)	Justification	Source
27.	Extension cord, 10m	10	Comparable item—Voltage stabilizers	WHO CHOICE database http://www.who.int/choice/costs/prices_t4/en/index.html
28.	Extension cord, 3m	10	Comparable item—Voltage stabilizers	WHO CHOICE database http://www.who.int/choice/costs/prices_t4/en/index.html
29.	Head torches	10	Comparable item—Voltage stabilizers	WHO CHOICE database http://www.who.int/choice/costs/prices_t4/en/index.html
30.	Multi-plug adapter, 5 socket	10	Comparable item—Voltage stabilizers	WHO CHOICE database http://www.who.int/choice/costs/prices_t4/en/index.html
31.	Plastic tables	5	Comparable item—Plastic baskets and hampers	United Policyholders insurance company http://www.uphelp.org/pdfs/Depreciation_CP.pdf
32.	Plastic chairs	5	Comparable item—Plastic baskets and hampers	United Policyholders insurance company http://www.uphelp.org/pdfs/Depreciation_CP.pdf
33.	Stackable plastic containers	5	Comparable item—Plastic baskets and hampers	United Policyholders insurance company http://www.uphelp.org/pdfs/Depreciation_CP.pdf
34.	Waste bin	5	Comparable item—Plastic baskets and hampers	United Policyholders insurance company http://www.uphelp.org/pdfs/Depreciation_CP.pdf
35.	Screens (3m x 2m)	5	Comparable item—Plastic baskets and hampers	United Policyholders insurance company http://www.uphelp.org/pdfs/Depreciation_CP.pdf
36.	Mop + Bucket	5	Comparable item—Plastic baskets and hampers	United Policyholders insurance company http://www.uphelp.org/pdfs/Depreciation_CP.pdf
37.	20L Buckets with Taps and Lids	5	Comparable item—Plastic baskets and hampers	United Policyholders insurance company http://www.uphelp.org/pdfs/Depreciation_CP.pdf
38.	Buckets for instrument disinfection	5	Comparable item—Plastic baskets and hampers	United Policyholders insurance company http://www.uphelp.org/pdfs/Depreciation_CP.pdf
39.	Medical plastic bin (small)	5	Comparable item—Plastic baskets and hampers	United Policyholders insurance company http://www.uphelp.org/pdfs/Depreciation_CP.pdf
41.	Medical plastic bin (large)	5	Comparable item—Plastic baskets and hampers	United Policyholders insurance company http://www.uphelp.org/pdfs/Depreciation_CP.pdf

#	Item	Amortization Period (Years)	Justification	Source
42.	Detergent soap bucket	5	Comparable item—Plastic baskets and hampers	United Policyholders insurance company http://www.uphelp.org/pdfs/Depreciation_CP.pdf
43.	Broom	5	Comparable item—Plastic baskets and hampers	United Policyholders insurance company http://www.uphelp.org/pdfs/Depreciation_CP.pdf
44.	Markers	8	Comparable item—Office furniture	(Changed model default of 7 years) WHO CHOICE database http://www.who.int/choice/costs/prices_t4/en/index.html
45.	Pens	8	Comparable item—Office furniture	(Changed model default of 7 years) WHO CHOICE database http://www.who.int/choice/costs/prices_t4/en/index.html
46.	Tap stand	7	Comparable item—Other	DMPPT default
47.	Water tank	7	Comparable item—Other	DMPPT default
48.	Tents	7	Comparable item—Other	DMPPT default
49.	Vehicles—4WD	8	Comparable country—4WD in Kenya	WHO CHOICE database http://www.who.int/choice/costs/prices_t4/en/index.html
50.	Laryngoscope	5	Comparable item—Examination, surgery equipment	DMPPT default
51.	Glucometer	5	Comparable item—Examination, surgery equipment	DMPPT default
52.	BP machine	5	Comparable item—Examination, surgery equipment	DMPPT default
53.	Safety box/sharps box	7	Comparable item—Laboratory equipment	DMPPT default
54.	Ambu bags	5	Comparable item—Examination, surgery equipment	DMPPT default

APPENDIX 2: ASSUMPTIONS AND LIMITATIONS

#	Item	Justification	Source
Unit cost calculations			
1.	*Commodity prices:* When prices are unavailable for specific facility, use comparable numbers from other implementers.	Consistency in unit cost calculations.	Data collected from facilities
2.	*Target period for analysis:* Unit cost analysis based on 2010 calendar year data.	Best data available for this period.	Implementing partners in Tanzania (MCHIP, ICAP, DOD)
3.	*Three levels of unit cost analysis:* Unit cost calculation is done separately for three modes of service delivery: 1. VMMC non-campaign 2. VMMC campaigns 3. VMMC island outreach sites VMMCs performed during campaign were subtracted from total VMMCs performed at the facility to arrive at the number of VMMCs done outside of campaigns.	Wide variations in unit costs exist between the two modes of service delivery. Number of VMMCs performed during a campaign period is much higher than outside of campaign. As a result, campaigns are more cost-effective. Island—very high expenses for fewer people will skew costs if included in the campaign; a separate unit cost analysis is best.	Costing team based on a review of financial data
4.	*Annualized data:* For facilities that were operational for only part of the year in 2010, data were annualized to ease comparison. (VMMCs performed during campaigns were first subtracted from the total number to reflect VMMCs done outside of campaign.) For all regions: ○ Subtracted campaign clients from total VMMCs ○ Remainder = number of non-campaign VMMCs ○ For example, to annualize 11 months: (∑11 months/11)*12	Data available for: *Iringa*: ○ Iringa Regional Hospital – 11 Months ○ Lugoda – 7 Months ○ Ngome – 6 Months ○ Mafinga – 6 Months ○ Tosamaganga – 6 Months *Mbeya*: ○ Metta Hospital – 8 months ○ Mbeya Referral Hospital – 11 months ○ Mbalizi – 11 Months ○ Mbeya Regional Hospital – 4 months	MCHIP managed by Jhpiego (implementer in Iringa) DOD (implementer in Mbeya) ICAP (implementer in Kagera)

#	Item	Justification	Source
		Kagera: ○ Rubya - Months ○ Kagera Regional Hospital – 11 Months	Costing team calculations
5.	*Extrapolation of unit costs to other 5 regions:* ○ Non-VMMC regions will remain constant. ○ VMMC levels will hold constant.		
6.	*Campaign data:* ○ Unit cost calculations are based on total duration of campaigns in that region.	○ For example, Iringa did two campaigns in 2010 (June/July & December) for a total of 8 weeks. ○ Unit cost calculation based on 8 weeks for Iringa region.	○ Data collected from facilities ○ Costing team calculations
7.	*Average length of stay*: ○ 5 days	Needed to calculate number of in-patient days per year.	Dr. Faustine Njau National Program Officer, WHO, Tanzania
Personnel expenses			
8.	*Inclusion of expenses on service personnel:* This analysis only includes the counseling and surgical team that performs VMMCs and not all personnel trained for VMMC at the site (but not actively involved).	To capture actual field costs.	Costing team based on a review of available data
9.	*Personnel benefits:* Benefits are included in the salary for all personnel providing VMMC. Data: ○ Indirect costs—overheads ○ Direct costs—personnel (benefits are 3% of salary)	3% contributed by government to medical coverage (part of national health insurance).	Source: MOH interviews
10.	*Accounting for overtime:* Overtime paid to VMMC providers (for campaign and non-campaign facilities) is rolled into benefits.	To capture actual field costs.	Data collected from facilities

#	Item	Justification	Source
11.	*Costs of training personnel:* Used one implementer data (MCHIP) for all regions.	MCHIP conducting training for service providers for all implementers.	MCHIP training expense sheet
12.	*In-service training:* Used default assumption in model =10 % of salary of personnel.	In Tanzania, Ministry pays for in-service training, not added to salary. Added to salary in our costing sheet for ease of calculation.	
13.	*Direct-cost personnel:* Changed personnel time requirements per VMMC intervention.	Match actual time taken in the field.	Data collected from facilities
Other expenses			
14.	*Demand creation costs:* Community mobilization costs and demand-creation costs as incurred by the implementers are excluded from the unit cost analysis.	Demand-creation costs are excluded even if the implementer incurred such expenses in 2010. These costs are calculated in total for all 8 regions (where VMMC is currently offered or will be offered). This total cost is used in the impact model.	Costing team
15.	*Supply chain costs:* Items directly related to service delivery at a facility (e.g., equipment, kits, etc.) are included in the unit cost of individual commodities. Costs associated with multiple facilities and maintaining a supply chain system (e.g., transportation of the kits, quality control, labor costs, etc.) are calculated separately as a total for all the facilities.	Unit cost for all items includes all supply chain costs (i.e., warehousing, quality control, etc.) Supply chain costs vary with the size of the order.	
16.	*Adverse events data:* Default values for haemorrhage and sepsis are too high for Tanzania. Use available data to extrapolate to other facilities.	Data not available in this format for all facilities.	Implementing partners in Tanzania (JMCHIP, ICAP, DOD) Costing team calculations

REFERENCES

Auvert, B., D. Taljaard, E. Lagarde, et al. 2005. "Randomized, controlled intervention trial of male circumcision for reduction of HIV infection risk: The ANRS 1265 trial." *PLoS Medicine* 2(11): e298.

Auvert, B., E. Marseille, E.L. Korenromp, et al. 2008. "Estimating the resources needed and savings anticipated from roll-out of adult male circumcision in sub-Saharan Africa." *PLoS One* 3(8): e2679.

Bollinger, L., W.D. Cormier Plosky, and J. Stover. 2009a. *Male Circumcision: Decision Makers' Program Planning Tool, Calculating the Cost and Impacts of a Male Circumcision Program*. Washington, DC: Futures Group, USAID | Health Policy Initiative, Task Order 1, and United Nations Program on HIV/AIDS.

Bollinger, L.A., J. Stover, G. Musuka, et al. 2009b. "The cost and impact of male circumcision on HIV/AIDS in Botswana." *J Int AIDS Soc* 12:7.

Demographic and Health Survey (Tanzania). 2010.

Demographic and epidemiologic data from Spectrum files using country-specific data from UNAIDS, UN Population Division.

Hallett, T.B., K. Singh, J.A. Smith, R.G. White, L.J. Abu-Raddad, and G.P. Garnett. 2008. "Understanding the impact of male circumcision interventions on the spread of HIV in southern Africa." *PLoS One* 3: e2212.

James, G., J.G. Kahn, E. Marseille, and B. Auvert. 2006. "Cost-effectiveness of male circumcision for HIV prevention in a South African setting." *PLoS Med* 3(12): e517.

MOHSW. 2010. *National Strategy for Scaling Up male Circumcision for HIV Prevention*.

MOHSW. 2009. *Situation Analysis for Male Circumcision in Tanzania.*

Njeuhmeli, E., S. Forsythe, J. Reed, M. Opuni, L. Bollinger, N. Heard, D. Castor, J. Stover, T. Farley, V. Menon, and C. Hankins. 2011. Voluntary Medical Male Circumcision: Modeling the Impact and Cost of Expanding Male Circumcision for HIV Prevention in Eastern and Southern Africa. *PloS Med* 8(11): e1001132.

UNAIDS informational website on medical MC. Available at: http://www.malecircumcision.org.

Williams, B.G., J.O. Lloyd-Smith, E. Gouws, C. Hankins, W.M. Getz, et al. 2006. "The potential impact of male circumcision on HIV in sub-Saharan Africa." *PLoS Med* 3(7).

WHO. 2010. *Considerations for Implementing Models for Optimizing the Volume and Efficiency of Male Circumcision Services*. Geneva: WHO.

WHO and UNAIDS. 2008. *Operational Guidance for Scaling Up Male Circumcision Services for HIV Prevention*. Geneva: WHO.

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