HEALTH POLICY INITIATIVE

The Potential Cost and Impact of Expanding Male Circumcision in 14 African Countries

In support of efforts to scale-up male circumcision (MC) in PEPFAR programs, readily available data have been applied to estimate the potential cost and impact of scaling-up medical male circumcision services in 14 countries in Eastern and Southern Africa to reach 80 percent of adult (ages 15–49 years) and newborn males by 2015. These countries include Botswana, Ethiopia (Gambela region only), Kenya (Nyanza Province only)[1], Lesotho, Malawi, Mozambique, Namibia, Rwanda, South Africa, Swaziland, Tanzania, Uganda, Zambia, and Zimbabwe.

The results presented here illustrate one of several possible scenarios; the scenarios can be modified to reflect a variety of possible policies at the country level. Key conclusions from this initial scenario are that scaling up the program could prevent more than 4 million adult HIV infections during 2009 to 2025, result in cumulative net savings of US$20.2 billion over the same time period, and require almost 12 million male circumcisions to be performed in the peak year (2012). Between 2015 and 2025, the number of male circumcisions required drops to between 4 and 5 million annually and eventually declines further and stabilizes at about 3 million newborn circumcisions annually.

Key Messages

Scaling up male circumcision to reach 80 percent of adult and newborn males in 14 African countries by 2015 could potentially

- avert more than 4 million adult HIV infections between 2009 and 2025, with 10 of the 14 countries averting more than 19 percent of new HIV infections by 2025;
- yield annual cost savings of US$1.4 – 1.8 billion after 2015, with a total net savings of US$20.2 billion between 2009 and 2025;
- require almost 12 million male circumcisions in the peak year (2012) and 4–5 million circumcisions annually thereafter;
- cost an additional US$420 million in the peak year (2012) and US$125 million annually from 2015, with a total of US$2.5 billion between 2009 and 2025; and
- result in a net cost per HIV infection averted of US$500 or less for six of the 14 countries.

[1]For 60 percent of adult males by 2014

September 2009

Male Circumcision: Decision Makers' Program Planning Tool

In March 2007, participants at a high-level consultative meeting held by the Joint United Nations Program on HIV/AIDS (UNAIDS) and the World Health Organization (WHO) concluded that male circumcision should be a priority prevention service in countries with high HIV prevalence rates and low prevalence of MC, due to its effectiveness in reducing men's risk of acquiring HIV. To further support MC program planning, the USAID | Health Policy Initiative collaborated with UNAIDS to develop the Male Circumcision: Decision Makers' Program Planning Tool to assist countries in developing policies for scaling up services to provide medical male circumcision. This tool allows analysts and decision makers to understand the costs and impacts of different policy options regarding the introduction or expansion of medical male circumcision services. It is part of a larger toolkit developed by UNAIDS/WHO that provides guidelines on comprehensive approaches to male circumcision, including types of surgical procedures and key policy and cultural issues. The key policy options addressed by the model are the following:

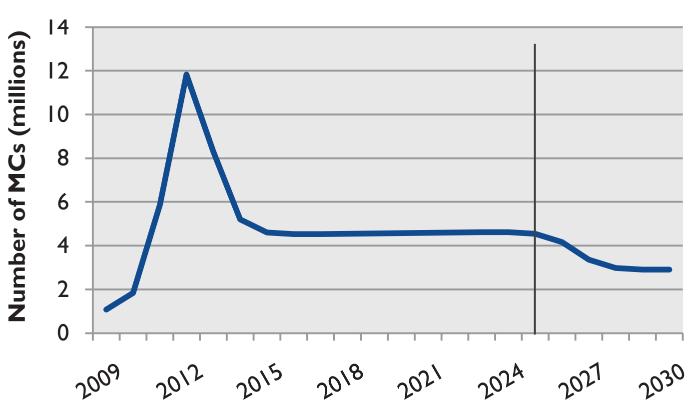
- Priority populations: all male adults, young male adults, adolescent males, male newborns, and men at higher risk of HIV exposure
- Target coverage levels and rates of scale-up
- Service delivery modes: hospital, clinic, outreach, mobile van; public, private, nongovernmental organization, and "other"
- Task shifting and task sharing: surgeon, family physician, and clinical officer[2]

Results presented are for the 14 different countries previously listed. Some results are for all 14 countries combined; other results are presented for individual countries. Country-specific cost data were used for Botswana, Lesotho, Namibia, Swaziland, and Zambia, while default unit costs (based upon regional averages) were used for the other countries. Results are shown through 2025, except for the number of new male circumcisions required annually, which is extended to 2030 to illustrate the number required over the long term. **Table 1** in the Annex summarizes the results. A description of the model methodology and a listing of key data sources are on pages 6–7.

Results

Number of Male Circumcisions Required across 14 Countries. A rapid scale-up to reach 80 percent of adult and newborn males by 2015[3] would result in a large increase in the number of circumcisions required per year in the short term, peaking at almost 12 million circumcisions in 2012 and dropping to about 4.5 million circumcisions annually from 2015 to 2025 (see **Figure 1**). The long-term equilibrium of about 3 million circumcisions annually represents approximately 80 percent of newborn males from 2030, since all adults and adolescents requesting circumcision would have received it by that time.

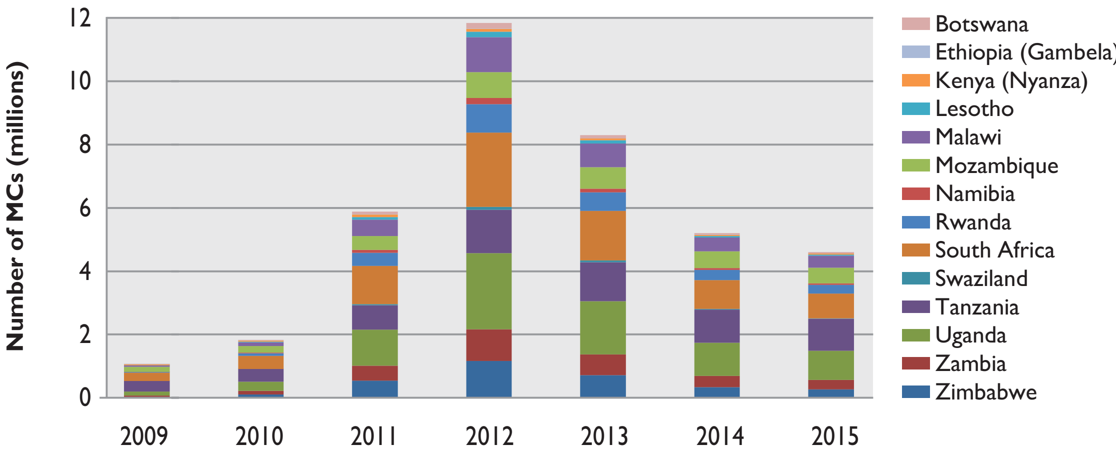
Figure 1. Total Number of Male Circumcisions, 2009–2030



[2]Task shifting refers to moving the complete male circumcision surgery to less specialized workers, such as from a surgeon to a clinical officer, while task sharing moves specific steps of the surgery to less specialized workers.
[3]Except for Nyanza province in Kenya where the target is 60 percent of adult males by 2014.

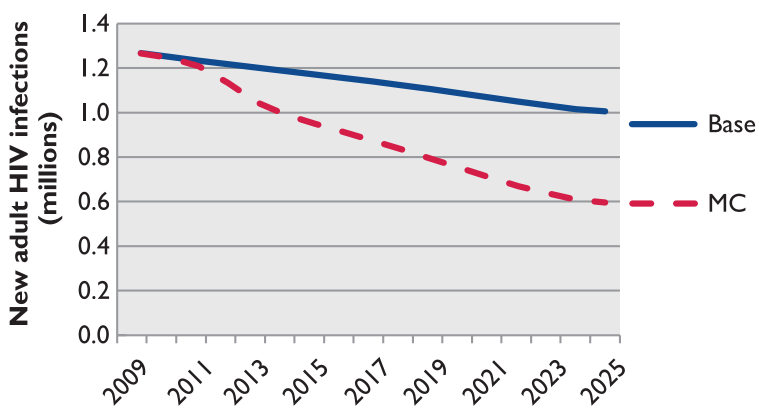
Number of Male Circumcisions by Country, 2009–2015. The heaviest service burden would be experienced in five countries during the peak service year. South Africa and Uganda would require more than 2 million circumcisions in 2012; Malawi, Tanzania, and Zimbabwe would each require more than 1 million circumcisions (see **Figure 2**).

Figure 2. Number of Male Circumcisions by Country, 2009–2015



New Adult HIV Infections during 2009–2025 across 14 Countries. Scaling up medical male circumcision services to reach 80 percent of all adult and newborn males by 2015 would reduce the number of new adult HIV infections substantially by the end of 2025 (see **Figure 3**). By the end of 2025, the number of annual new infections would decline from about 1,000,000 to 596,000, or 40 percent of all new adult infections that would have occurred otherwise in the Base scenario.[4]

Figure 3. New Adult HIV Infections for 14 Countries by Scenario

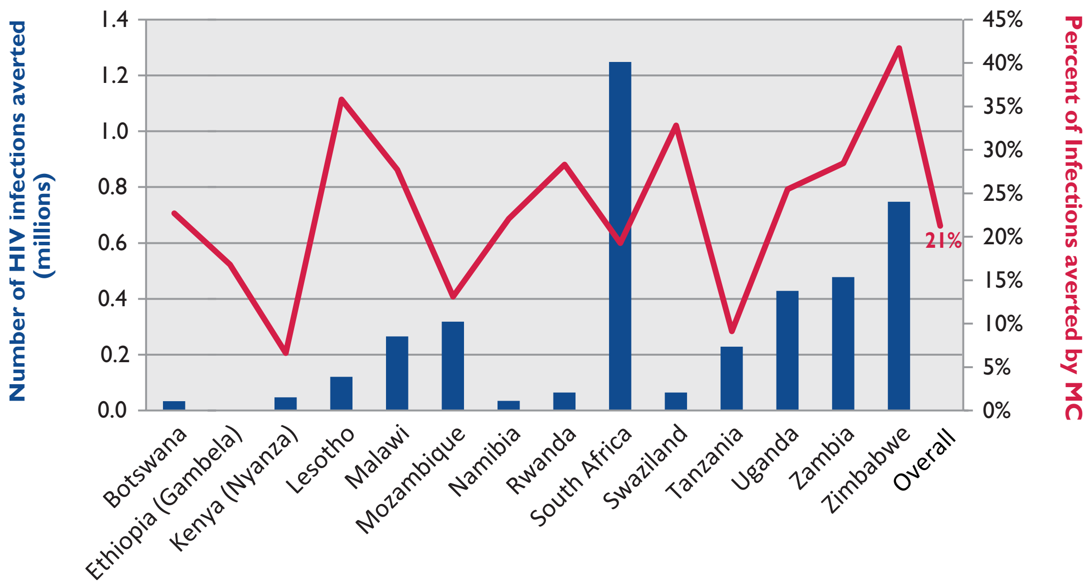


Cumulative HIV Infections Averted during 2009–2025. The scaling up of medical male circumcision would reduce the cumulative number of new adult HIV infections by more than 4 million by the end of 2025, or 21 percent of adult HIV infections that would have occurred otherwise in the Base scenario. At the country level, the largest number of HIV infections averted between 2009 and 2025 could occur in South Africa, with more than 1.2 million adult HIV infections averted (see **Figure 4**). Note that scaling up only newborn male circumcision would not result in adult infections being averted until the newborns have grown up and become sexually active. As a result, most infections would not begin to be averted from newborn male circumcision until well after 2025.

[4]The base scenario assumes that current levels of male circumcision continue through 2025. MC refers to the male circumcision scale-up scenario.

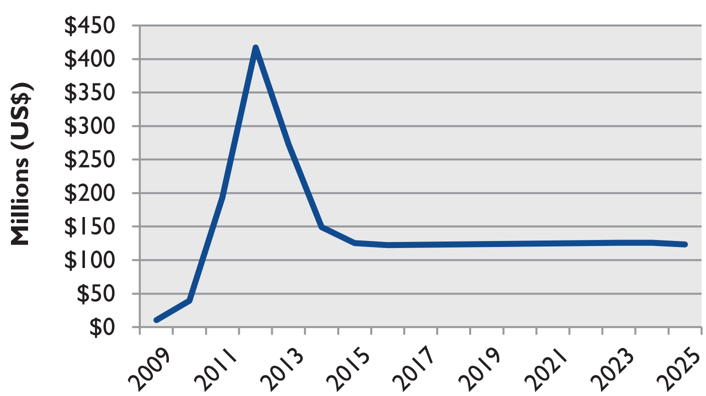
An overall perspective on infections averted is shown in **Figure 4** by overlaying a line displaying the cumulative percent of adult HIV infections averted for 2009–2025 (the cumulative number of adult HIV infections averted between 2009–2025 divided by the cumulative number of adult HIV infections in the Base scenario) over the columns that depict the cumulative number of adult HIV infections averted between 2009–2025 for each country. The dramatic impact of male circumcision is displayed in the figure; by 2025, between five and 40 percent of adult HIV infections across the 14 countries would have been averted due to scaling up medical male circumcision services. Lesotho, Swaziland, and Zimbabwe could each prevent more than 30 percent of their anticipated incident HIV infections by scaling up male circumcision. Ten of the 14 countries could avert more than 19 percent of new adult HIV infections by scaling up male circumcision including Botswana (23%), Lesotho (36%), Malawi (28%), Namibia (22%), Rwanda (28%), South Africa (19%), Swaziland (33%), Uganda (26%), Zambia (28%), and Zimbabwe (42%). For all 14 countries, 4.1 million HIV infections would be averted between 2009 and 2025, representing 21 percent of projected new adult HIV infections.

Figure 4. Cumulative Number and Percentage of HIV Infections Averted between 2009-2025 by Scaling up Male Circumcision



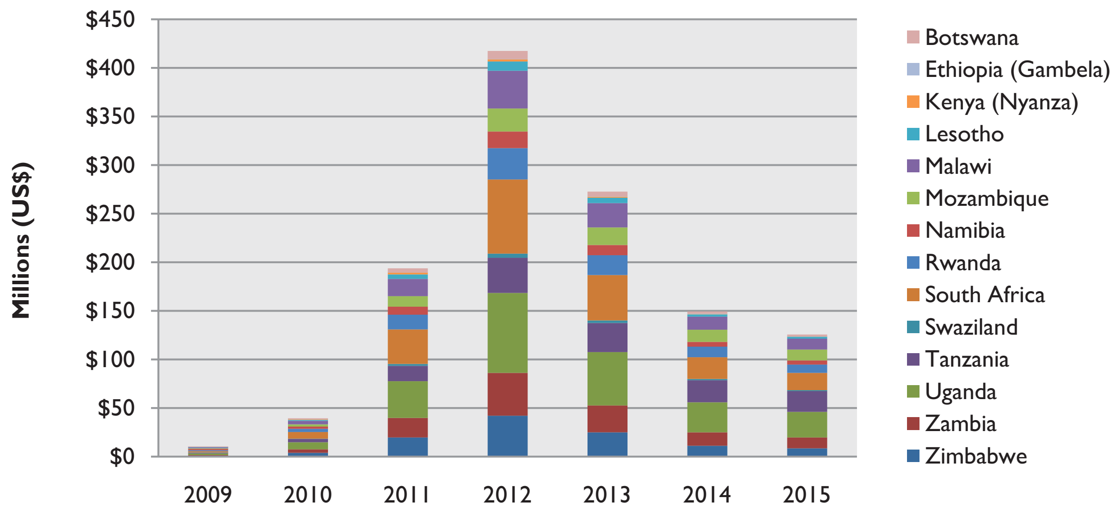
Additional Cost of Scaling up Medical Male Circumcision for 14 Countries. The additional cost of scaling up medical male circumcision across all 14 countries increases rapidly over the short term, peaking at US$417 million in 2012 (see **Figure 5**). After the initial intensive scale-up of services through 2015, total annual costs decline to about US$125 million in the long term.

Figure 5. Additional Cost of Scaling up Male Circumcision for 14 Countries (millions of US$)



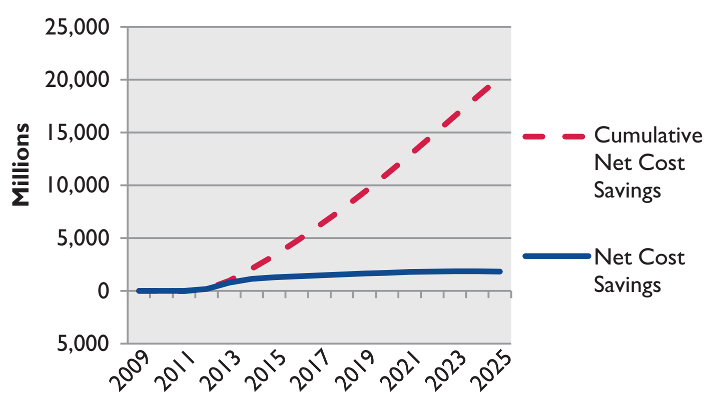
A closer look at the country-level results for scaling up male circumcision in the short term reveals that there is a large variation in the resources required (see **Figure 6**). For example, in the peak year 2012, total costs at the country level range from a low of US$0.4 million in Ethiopia (for Gambela Region only) to a high of US$82 million in Uganda. By 2015 the total costs have declined to US$125 million, ranging from US$ 0.2 million in Ethiopia (Gambela Region only) to US$ 26.5 million in Uganda, with more than half of the countries in the range of US$1.8 million to US$11 million.

Figure 6. Additional Cost of Scaling up Male Circumcision by Country (millions US$)



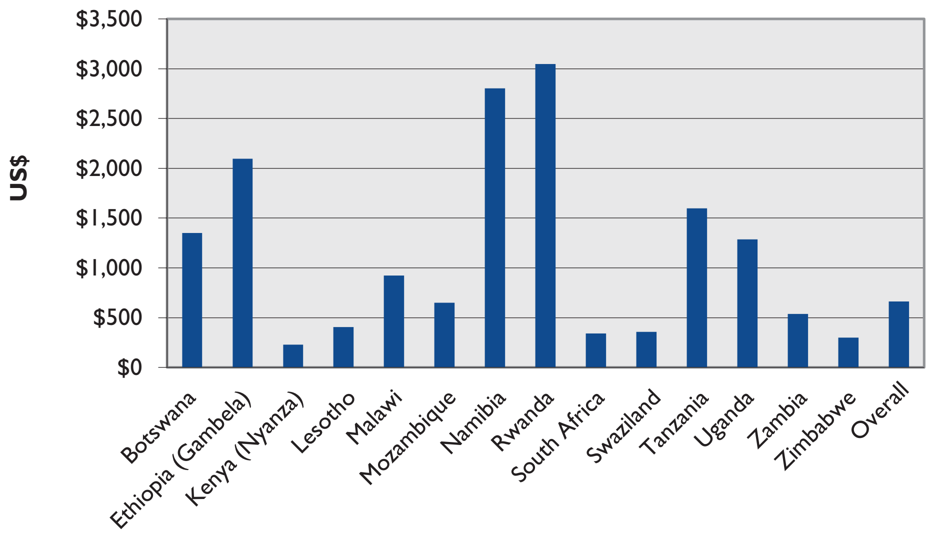
Net Cost Savings and Cumulative Net Cost Savings for 14 Countries. The discounted net cost savings in billions of dollars are displayed in **Figure 7**, defined as lifetime antiretroviral therapy costs (multiplied by the annual number of infections averted) less the cumulative net costs of implementing the circumcision program. The program begins generating a net cost savings beginning in 2012 and by 2014 the net cost savings exceed US$1 billion. From 2015 through 2025 the total annual cost savings are in the range of US$1.4 – 1.8 billion. By 2017 the cumulative net cost savings exceed US$5 billion and climb steadily to US$20 billion by 2025.

Figure 7. Discounted Net Cost Savings and Cumulative Net Cost Savings for 14 Countries



Cost per HIV Infection Averted. The discounted net cost per adult HIV infection averted is the cumulative incremental net costs incurred through implementing the scaled-up male circumcision program and discounted appropriately, divided by the cumulative number of adult HIV infections averted over the relevant timeframe and discounted appropriately (see **Figure 8**). The net cost per adult HIV infection averted drops substantially once the number of adult HIV infections averted increases, with the highest cost, more than US$3,000, estimated for Rwanda. The net cost per HIV infection averted is US$500 or less for six countries (Kenya, Lesotho, South Africa, Swaziland, Zambia and Zimbabwe); overall the net cost per HIV infection averted is US$662.

Figure 8. Discounted Net Costs per HIV Infection Averted (Cumulative 2009-2025)



Further Methodological Details on Model

The Male Circumcision: Decision Makers' Program Planning Tool (DMPPT) was developed by the USAID | Health Policy Initiative in collaboration with UNAIDS. The tool calculates the cost of male circumcision services by delivery mode based on clinical guidelines and locally derived inputs on staff time and salaries, supplies, equipment, and shared facility and staff costs. It estimates the impact on the epidemic using a transmission model that calculates new infections by sex and two age groups that can vary as a function of the current force of infection, coverage levels, and speed of scale-up. The tool incorporates sensitivity analysis for key inputs, including a direct impact of male circumcision on HIV risk in women, and was refined through consultations with key MC modeling groups (see UNAIDS/WHO/SACEMA Expert Group, 2009).

The DMPPT also allows choice of the intended target population by age (newborn, adolescent, adult) and risk (e.g., sexually transmitted disease clinic attendees, sero-negative men in discordant partnerships); service delivery mode (hospital, clinic, campaign); provider (surgeon, family physician, clinical officer); adverse events; ancillary services (HIV testing and counselling; programs promoting gender sensitivity); potential risk compensation (increased number of sexual partners, decreased condom use); scale-up rate; and coverage goals. The tool estimates HIV incidence, HIV prevalence, AIDS deaths, overall costs, and net cost per HIV infection averted as a function of the number of male circumcisions performed for each service delivery and coverage timeframe option.

Limitations of the model include issues regarding data (e.g., male circumcision rates are self-reported in the Demographic and Health Surveys and so may be biased). In addition, the model is also limited by several simplifying assumptions that are made, including the lack of a sexual mixing matrix and the use of HIV prevalence used to fit the epidemic model rather than HIV incidence.

A complete description of the variables and equations used in the model can be found in the "Methods" worksheet in the DMPPT, available at: http://www.malecircumcision.org.

Acknowledgments

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Sources:

1. Demographic and epidemiologic data from Spectrum files using country-specific data from UNAIDS and UN Population Division.
2. UNAIDS Epidemiological Fact Sheet on HIV and AIDS, various countries. Available at: http://www.who.int/globalatlas/.
3. Male Circumcision: Decision Makers' Program Planning Tool. Model and manual are available at: http://www.malecircumcision.org.
4. UNAIDS informational website on medical MC available at http://www.malecircumcision.org.
5. UNAIDS/WHO/SACEMA Expert Group on Modelling the Impact and Cost of Male Circumcision for HIV Prevention. 2009. Male circumcision for HIV prevention in high HIV prevalence settings: What can mathematical modelling contribute to informed decision making? *PLoS Medicine*. 6(9):e1000109, September 2009.
6. World Development Indicators database, various years.
7. The Potential Cost and Impact of Male Circumcision, various countries, available at: www.malecircumcision.org.

Annex. Results Summary and Methodology

Table 1. Results Summary and Methodology

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Total number of MCs (thousands)	1,072	1,832	5,877	11,829	8,296	5,197	4,599	4,525	4,526	4,539	4,553	4,568	4,582	4,596	4,609	4,610	4,546
Infections averted (thousands)	0.5	4.1	25	84	155	197	221	243	265	288	312	336	359	380	394	405	410
Cumulative number of infections averted since 2009 (thousands)	0.5	4.6	29	113	269	465	687	930	1,195	1,483	1,795	2,131	2,490	2,870	3,264	3,669	4,079
Cost savings (millions US$)	-7	-8	-9	191	785	1,136	1,273	1,370	1,460	1,548	1,632	1,712	1,785	1,838	1,849	1,849	1,818
Cumulative cost savings since 2009 (millions US$)	-7	-15	-24	166	952	2,087	3,360	4,730	6,190	7,738	9,370	11,082	12,867	14,705	16,554	18,403	20,221

For more information

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