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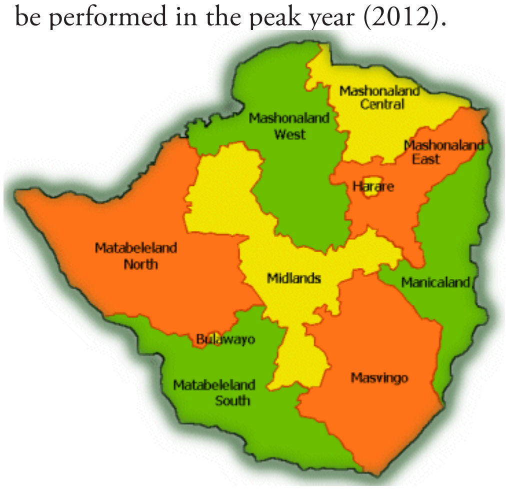
The Potential Cost and Impact of Expanding Male Circumcision in Zimbabwe

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 MC services in Zimbabwe to reach 80 percent of adult (ages 15–49) and newborn males by 2015. The results presented here illustrate only one possible scenario; 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 would result in averting almost 750,000 adult HIV infections over the time period from 2009 to 2025, would result in cumulative net savings of more than US$3.8 billion over the same time period, and would require more than 1.1 million MCs to be performed in the peak year (2012).

Key Messages

Scaling up male circumcision to reach 80 percent of adult and newborn males in Zimbabwe by 2015 would

- avert almost 750,000 adult HIV infections between 2009 and 2025;
- yield total net savings of more than US$3.8 billion between 2009 and 2025; and
- require more than 1.1 million MCs in the peak year (2012).



Background

At the end of 2007, overall adult HIV prevalence in Zimbabwe was 15.3 percent—one of the highest rates in the world. According to the 2005/2006 Demographic and Health Survey, 10.3 percent of adult males are circumcised. The distribution of those circumcised is fairly uniform across regions, except for a relatively higher rate in Matabeleland North (18.8%) and a relatively lower rate in Mashonaland Central (5.3%).

Male Circumcision: Decision Makers' Program Planning Tool

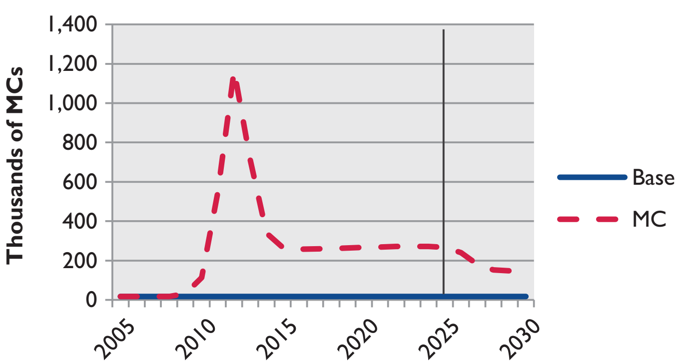
In March 2007, participants at a high-level consultative meeting held by the Joint United Nations Program on HIV/AIDS (UNAIDS) and the World Health Organization (WHO) concluded that male circumcision should be a priority prevention service in countries with high HIV prevalence rates and low prevalence 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 decisionmakers 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[1]

In the results displayed in the following charts, "Base" refers to the Base case scenario (maintaining current levels of male circumcision throughout the time period), while "MC" refers to the male circumcision scale-up scenario. 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 results and describes the model methodology; **Table 2** lists key data assumptions; sources are listed on page 6.

Results

Figure 1. Number of New MCs Required for Adults (15–49) and Newborns (thousands)



If no MC scaling up occurs in Zimbabwe, the number of MCs that would maintain the current level of MC (10.3 percent of adult males) is about 17,000 per year (see **Figure 1**). A rapid scale-up to meet a national target of 80 percent by 2015 would result in a large increase in the number of new MCs required per year in the short term, peaking at more than 1.1 million in 2012 before reaching a new equilibrium of about 150,000 annually. The level would represent approximately 80 percent of newborn males in 2030, as all adults and adolescents requiring circumcision would have received it by that time.

[1]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.

Scaling up medical MC services to reach 80 percent of all adult and newborn males by 2015 would reduce the number of new adult HIV infections by more than 80 percent by the end of 2025 (see **Figure 2**). Over the time period 2009–2025, the total number of annual new infections would decline from about 123,000 to about 16,500, and the cumulative number of adult HIV infections averted would be almost 750,000 or 39 percent of all new adult infections that would have occurred otherwise in the Base scenario. Note that scaling up only newborn MCs would not result in adult infections being averted until after the newborns have grown up and become sexually active. As a result, most infections would not begin to be averted until after 2025.

The number of adult HIV infections averted is displayed in **Figure 3**. The solid line is the annual number of infections averted, while the dotted line is the cumulative number of infections averted between 2009 and 2025. The numerical results are also displayed in **Table 1** in the Annex. **Figure 3** shows the dramatic impact of MC; by 2025, cumulatively almost 750,000 adult HIV infections would have been averted due to scaling up medical MC services.

Figure 4 shows the number of MCs performed per adult HIV infection averted. This is calculated as the cumulative number of additional MCs that are performed, divided by the cumulative number of adult HIV infections averted over the respective time periods. The number of MCs per infection averted is high initially, but

Figure 2. New Adult HIV Infections by Scenario

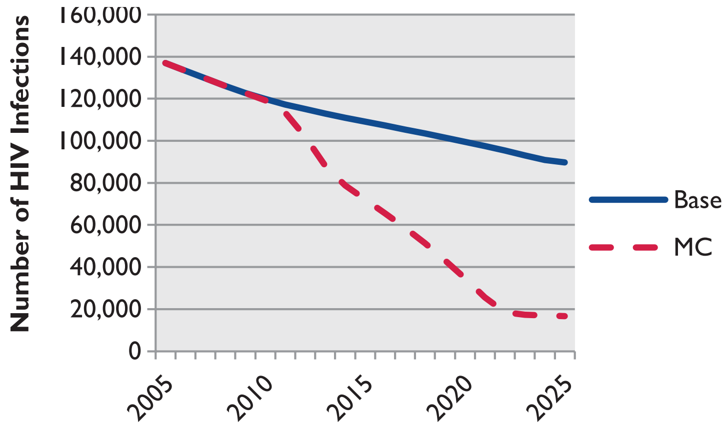


Figure 3. Infections Averted and Cumulative Infections Averted (thousands)

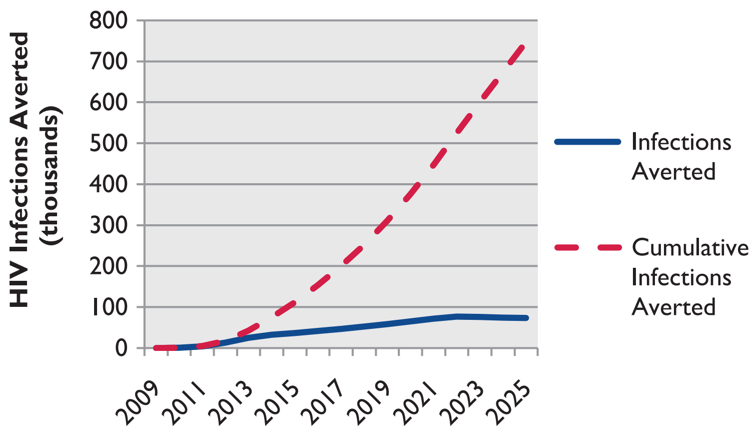
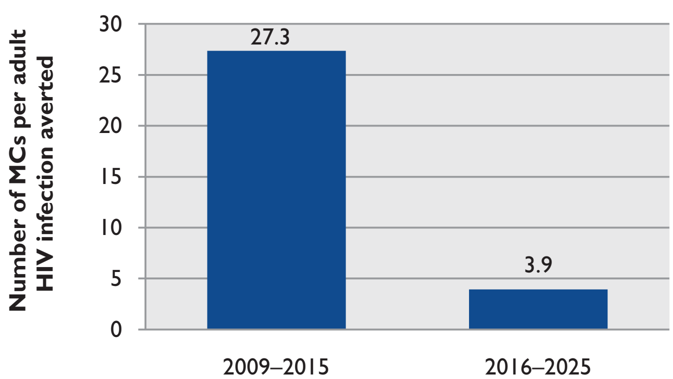


Figure 4. Number of MCs per Adult HIV Infection Averted



declines over time as the impact of MC grows. The number of MCs required to avert one infection drops substantially, reaching 3.9 during the time period 2016–2025.

Figure 5. Costs for Scaled-up MC Program with Different Unit Costs (millions US$)

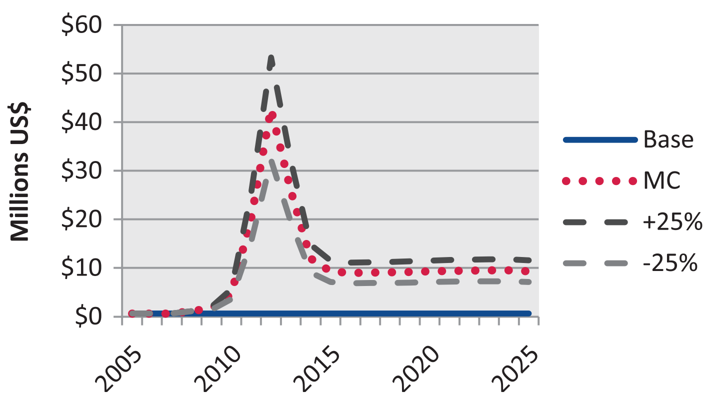
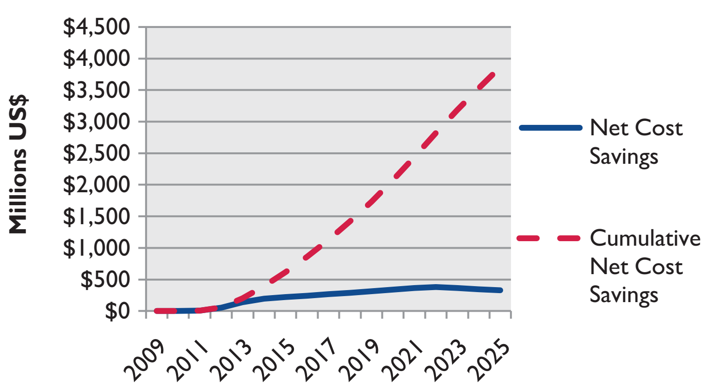


Figure 6. Discounted Net Cost Savings and Cumulative Net Cost Savings (millions US$)

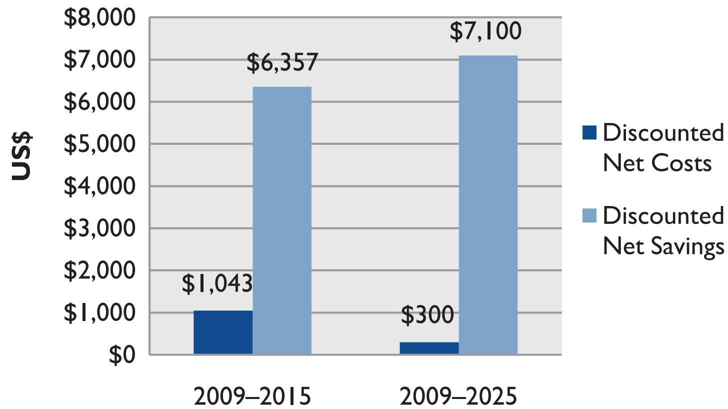


Assuming that 80 percent of new MCs are provided through the public sector and 20 percent are provided through the private sector, the resources required to scale up medical MC services are shown in **Figure 5**. The underlying unit cost assumptions for both adult and newborn MCs are listed in **Table 2** in the Annex. In addition, we assume that US$500,000 is spent annually on public education activities (all costs are in US$ in order to compare results across countries). Total annual costs peak at more than US$42 million in 2012—a net increase of US$41 million more than current MC expenditure levels, assuming similar unit costs. Costs are lower after the initial intensive scaling up occurs, declining to about US$9 million between 2015 and 2025—a net increase of about US$8.5 million more than current levels. If the unit cost in Zimbabwe is 25 percent higher than the UNAIDS default values, total costs peak at US$53 million in 2012 before declining to around US$11.6 million in the later time period. If the unit cost is 25 percent lower, total costs peak at US$32 million before declining to about US$7 million between 2015 and 2025.

The discounted net cost savings in millions of dollars are displayed in **Figure 6**—defined as the lifetime antiretroviral therapy costs (multiplied by the annual number of infections averted), less the cumulative net costs of implementing the scaled-up MC program. Over the time period 2009–2025, the cumulative net cost savings increase rapidly, reaching more than US$3.8 billion by 2025.

The discounted net cost and discounted net savings per adult HIV infection averted are also calculated using the results above. The discounted net cost per adult HIV infection averted is the cumulative incremental net costs incurred through implementing the scaled-up MC program, divided by the cumulative number of adult HIV infections averted over the relevant timeframe and discounted appropriately. Net cost savings is defined as above and then is divided by the cumulative number of adult HIV infections averted over the relevant timeframe and discounted appropriately. The results are displayed in **Figure 7**; details of the underlying data are shown in **Table I** in the Annex. The net cost per adult HIV infection averted drops substantially in the longer term from US$1,043 to US$300 once the number of adult HIV infections averted increases. The net savings per infection averted far outweigh the net costs over the long term, reaching US$7,100 over the entire time period 2009–2025.

Figure 7. Discounted Net Costs/Savings per Adult HIV Infection Averted (US$)



A final question is what kind of impact scaling up MC would have on the HIV epidemic if other prevention programs are scaled up as well. Results (not shown here) indicate that, if all other prevention interventions are scaled up to reach 80 percent coverage by 2015 with maximum impact, adding a scaled-up program of medical MC to the scaled-up prevention interventions results in a further decline in the number of new adult HIV infections from 25,000 to a level of about 18,000 in 2025. Thus, a scaled-up MC program in the presence of scaled-up other prevention activities (assuming maximum impact) would have synergistic effects, hastening the decline in the number of new HIV infections in Zimbabwe.

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 for 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.

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Sources:

1. Demographic and epidemiologic data from Spectrum files using country-specific data from UNAIDS and UN Population Division.
2. Demographic and Health Survey for Zimbabwe, 2005–2006.
3. UNAIDS Epidemiological Fact Sheet on Zimbabwe, 2008 Update, available at: http://www.who.int/globalatlas/predefinedReports/EFS2008/full/EFS2008_ZW.pdf.
4. Male Circumcision: Decision Makers' Program Planning Tool. Model and manual are available at: http://www.malecircumcision.org.
5. UNAIDS informational website on medical MC, available at: http://www.malecircumcision.org.
6. 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.
7. World Development Indicators database, various years.

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)	33	113	545	1,167	713	339	267	259	259	262	264	267	270	272	273	273	268
Infections averted (thousands)	0.1	0.6	3.8	13.3	24.8	32.1	37	41.7	46.8	52.3	58.3	64.8	71.8	76.9	75.7	73.9	73.0
Cumulative number of infections averted since 2009 (thousands)	0.1	0.7	4.5	17.8	42.6	74.8	111.8	153.5	200.2	252.5	310.8	375.6	447.5	524.4	600.1	674	747
Cost savings (millions US$)	-0.5	0.7	8.1	51.2	140.9	195.4	222	244.1	266.5	290	314.7	340.3	366.7	381.5	364.7	345.4	331.2
Cumulative cost savings since 2009 (millions US$)	-0.5	0	8	59	200	396	618	862	1,128	1,418	1,733	2,073	2,440	2,822	3,186	3,532	3,863

Table 2. Key Data Assumptions

Indicator	Value	Source
Male circumcision prevalence (Males 15–49)	10.3%	2005–6 Zimbabwe DHS
HIV prevalence – 2007	15.3%	UNAIDS Epidemiological Fact Sheet, 2008 Update
Average unit cost for adult MC	US$37 ($28-$46)	UNAIDS (-/+ 25%)
Average unit cost for newborn MC	US$30 ($23-$38)	UNAIDS (-/+ 25%)
Annual public information cost	US$500,000	UNAIDS
Discounted lifetime antiretroviral therapy cost	US$7,400	UNAIDS; Assumes (a) 1st year continuation rate of 86%, 90% thereafter for both 1st and 2nd line antiretroviral therapy, (b) anti-retroviral drug prices trend to reach $210 for 1st line, $590 for 2nd line by 2015

For more information

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