HEART
HEALTH & EDUCATION ADVICE & RESOURCE TEAM

Helpdesk Report: Cost-effectiveness of male circumcision in reducing HIV

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Query: Is male circumcision a cost-effective intervention in reducing HIV?

Content

1. Overview

A critical evaluation of the evidence on the effectiveness of male circumcision (MC) concludes that implementation should be accelerated in sub-Saharan Africa (White et al., 2008). Experts reviewing six simulation models agree that programmes that focus on subpopulations with a high HIV prevalence and incidence would have substantial impact on HIV incidence (Hargrove et al., 2009).

The review of the six simulation models found estimates of costs per HIV infections averted (HIA) between $150 and $900 in high HIV prevalence settings over a 10-year time horizon, and $100 to $400 when including infections averted to 20 year. Cost-effectiveness models from individual studies estimate:

- With an HIV prevalence of 8.4%, the cost per HIA is $551 (80% CI $344–$1,071) and net savings are $753,000 (80% CI $0.3 million to $1.2 million) based on data from South Africa (Kahn et al., 2006).
- Using data from Uganda, Gray et al. (2007) estimated the cost per HIA to be $1,269–3,911.
- Modelling impact and costs of MC for Eastern and Southern Africa, Njeuhmeli et al. (2011) estimate net savings for Zimbabwe to be US$7,031 for 2011-2025.
- Costs per HIA based on Rwandan data is US$3,932 for adolescent MC and US$4,949 for adult MC (Binagwaho et al., 2010). This study also investigated neonatal MC which is considerably less expensive, US$15 instead of US$59 per procedure, though savings will be realised later in time.
- Estimates from Tanzanian data suggest costs per HIA to be US$11,300 during 2010–2015 and US$3,200 during 2010–2025 (Menon et al., 2014).
- The USAID Health Policy Initiative estimated cost-effectiveness in the settings of Swaziland (Bollinger et al., 2007a), Zambia (Bollinger et al, 2007b), and Lesotho (Bollinger et al., 2007c). Costs per HIA were US$176 in Swaziland, US$313 in Zambia, and US$292 in Lesotho.

Value-added comes from reduction in other sexually transmitted diseases (Hargrove et al., 2009).

Cost-effectiveness estimates identified are promising but vary widely, making it difficult to draw conclusions. Estimates are sensitive to inputs such as costing of the MC and treatment averted, the protective effect, and HIV prevalence. Estimates are also likely to vary over time due to inflation.

2. Evidence and models from peer-reviewed journals

UNAIDS/WHO/SACEMA Expert Group on Modelling the Impact and Cost of Male Circumcision for HIV Prevention. Male circumcision for HIV prevention in high HIV prevalence settings: What can mathematical modelling contribute to informed decision making?
Hargrove J, Williams B, Abu-Raddad L, Auvert B, Bollinger L, Dorrington R, & Lohse N. (2009). PLoS medicine, 6(9), e1000109.
http://journals.plos.org/plosmedicine/article?id=10.1371/journal.pmed.1000109

Mathematical models can estimate the population-level impact of male circumcision on HIV incidence in high HIV prevalence settings, but different methods, assumptions, and input variables can produce conflicting results. UNAIDS/WHO/SACEMA recently convened experts to review the outcomes of six simulation models on key policy and programmatic decision-making questions.

The expected impact of scaling up male circumcision services depends on several critical factors including baseline male circumcision and HIV prevalence; whether HIV incidence is increasing, stable, or declining; the time period of model projections; and the speed of scale-up.

WHO/UNAIDS guidance on programme implications states that the greatest potential public-health impact will be in settings where HIV is hyperendemic (HIV prevalence in the general population exceeds 15%) and is spread predominantly through heterosexual transmission, and where a substantial proportion of men (e.g., greater than 80%) are not circumcised. The six models, therefore, focused on settings that have an epidemic profile similar to this.

In countries with lower levels of HIV prevalence and incidence, such as Uganda, the number of male circumcisions required to avert one new infection is higher. However, on the basis of its analysis of the model predictions, the expert group agreed that even in such countries, programmes that focus on subpopulations with a high HIV prevalence and incidence would have substantial impact on HIV incidence. Subgroups might include HIV-negative men in serodiscordant couples and men more likely to have multiple sex partners, such as soldiers, truck drivers, miners, labour migrants, or patients attending sexually transmitted disease (STD) clinics. The expert group noted that, according to a systematic review and meta-analysis, men at higher risk of STD benefit from higher levels of protection when circumcised (adjusted risk ratio [RR]=0.29, 95% confidence interval [CI] 0.20–0.41).

All six models showed that women, even if not directly protected, would benefit indirectly from the introduction or expansion of male circumcision services because their probability of encountering an HIV-infected male sexual partner gradually declines with programme scale-up. In the models, these indirect benefits increase over time, taking some years to become evident. The expert group noted that these indirect benefits would eventually reduce the number of women needing services to prevent mother-to-child HIV transmission, although the proportion of people living with HIV who are women would increase.

In addition, the expert group reviewed empirical data that show that male circumcision reduces the acquisition of herpes simplex virus type-2, syphilis, and chancroid in HIV-negative men and accumulating evidence that the circumcision of HIV-positive men provides direct benefit to women by reducing genital ulcer disease, which may decrease the likelihood of HIV transmission. In a Ugandan trial, women who were the sexual partners of circumcised HIV-negative men had less genital ulcer disease and bacterial vaginosis, and fewer Trichomonas vaginalis infections than women with uncircumcised male partners. Although all these conditions, with the possible exception of bacterial vaginosis, are associated with an increased risk of female HIV acquisition, only one of the models analysed by the expert group explicitly included this mechanism, which was also not fully represented in another recent study.

The estimated costs per adult male circumcision are between $30 and $60 depending on the programme setting, with neonatal circumcision costing about one third of this amount. The models estimate costs per infection averted of between $150 and $900 in high HIV prevalence settings over a 10-y time horizon, and $100 to $400 when including infections averted to 20 y. All the models indirectly confirmed that the most favourable cost-effectiveness ratios will be seen where HIV incidence is highest. By comparison, estimates of discounted lifetime treatment costs typically exceed $7,000 per HIV infection if only first-line treatment is provided, and twice as much if second-line treatment is available. This estimate assumes first line antiretroviral treatment costs of $300 per patient per year rising to $500 by 2015, laboratory and service delivery costs of $300 per patient per year, survival of 85% in the first year after treatment initiation and 95% in subsequent years, and 3% discount rate. Thus, circumcising sexually active males of any age is likely to be cost saving.

As observed with antiretroviral treatment, a decrease in perceived risk can result in an increase in sexual risk-taking behaviour, a phenomenon termed ‘risk compensation’. The randomised trials of male circumcision and an observational study found minimal or no behavioural risk compensation among recently circumcised men, although intensive health education during the trials might have mitigated risk compensation.

Cost-effectiveness of male circumcision for HIV prevention in a South African setting
Kahn JG, Marseille E, Auvert B. PloS Med 2006;3(12): e517.
http://journals.plos.org/plosmedicine/article?id=10.1371/journal.pmed.0030517

Consistent with observational studies, a randomised controlled intervention trial of adult male circumcision (MC) conducted in the general population in Orange Farm (Gauteng Province, South Africa) demonstrated a protective effect against HIV acquisition of 60%. The objective of this study is to present the first cost-effectiveness analysis of the use of MC as an intervention to reduce the spread of HIV in sub-Saharan Africa.

Cost-effectiveness was modelled for 1,000 MCs done within a general adult male population. Intervention costs included performing MC and treatment of adverse events. HIV prevalence was estimated from published estimates and incidence among susceptible subjects calculated assuming a steady-state epidemic. Effectiveness was defined as the number of HIV infections averted (HIA), which was estimated by dynamically projecting over 20 years the reduction in HIV incidence observed in the Orange Farm trial, including secondary transmission to women. Net savings were calculated with adjustment for the averted lifetime duration cost of HIV treatment. Sensitivity analyses examined the effects of input uncertainty and programme coverage. All results were discounted to the present at 3% per year.

For Gauteng Province, assuming full coverage of the MC intervention, with a 2005 adult male prevalence of 25.6%, 1,000 circumcisions would avert an estimated 308 (80% CI 189–428) infections over 20 years. The cost is $181 (80% CI $117–$306) per HIA, and net savings are $2.4 million (80% CI $1.3 million to $3.6 million). Cost-effectiveness is sensitive to the costs

of MC and of averted HIV treatment, the protective effect of MC, and HIV prevalence. With an HIV prevalence of 8.4%, the cost per HIA is $551 (80% CI $344–$1,071) and net savings are $753,000 (80% CI $0.3 million to $1.2 million). Cost-effectiveness improves by less than 10% when MC intervention coverage is 50% of full coverage.

In settings in sub-Saharan Africa with high or moderate HIV prevalence among the general population, adult MC is likely to be a cost-effective HIV prevention strategy, even when it has a low coverage. MC generates large net savings after adjustment for averted HIV medical costs.

The impact of male circumcision on HIV incidence and cost per infection prevented: a Stochastic Simulation model from Rakai, Uganda
Gray RH, Li X, Kigozi G, Serwadda D, Nalugoda F, Watya S, Reynolds SJ, Wawer M.(2007). AIDS. Apr 23;21(7):845-850.
http://www.ncbi.nlm.nih.gov/pubmed/17415039

This research aimed to estimate the impact of male circumcision on HIV incidence, the number of procedures per HIV infection averted, and costs per infection averted.

A stochastic simulation model with empirically derived parameters from a cohort in Rakai, Uganda was used to estimate HIV incidence, assuming that male circumcision reduced the risks of HIV acquisition with rate ratios (RR) ranging from 0.3 to 0.6 in men, their female partners, and in both sexes combined, with circumcision coverage 0–100%. The reproductive number (R0) was also estimated. The number of HIV infections averted per circumcision was estimated from the incident cases in the absence of surgery minus the projected number of incident cases over 10 years following circumcision. The cost per procedure ($69) was used to estimate the cost per HIV infection averted.

Baseline HIV incidence was 1.2/100 person-years. Male circumcision could markedly reduce HIV incidence in this population, particularly if there was preventative efficacy in both sexes. Under many scenarios, with RR ≤ 0.5, circumcision could reduce R0 to < 1.0 and potentially abort the epidemic. The number of surgeries per infection averted over 10 years was 19–58, and the costs per infection averted was $1269–3911, depending on the efficacy of circumcision for either or both sexes, assuming 75% service coverage. However, behavioural disinhibition could offset any benefits of circumcision.

Voluntary medical male circumcision: modeling the impact and cost of expanding male circumcision for HIV prevention in Eastern and Southern Africa
Njeuhmeli E, Forsythe S, Reed J. (2011). PLoS Med 2011: 8(11):e1001132.
http://journals.plos.org/plosmedicine/article?id=10.1371/journal.pmed.1001132

There is strong evidence showing that voluntary medical male circumcision (VMMC) reduces HIV incidence in men. To inform the VMMC policies and goals of 13 priority countries in eastern and southern Africa, we estimate the impact and cost of scaling up adult VMMC using updated, country-specific data.

The authors use the Decision Makers' Program Planning Tool (DMPPT) to model the impact and cost of scaling up adult VMMC in Botswana, Lesotho, Malawi, Mozambique, Namibia, Rwanda, South Africa, Swaziland, Tanzania, Uganda, Zambia, Zimbabwe, and Nyanza Province in Kenya. Epidemiologic and demographic data from recent household surveys is used for each country.

The cost of VMMC ranges from US$65.85 to US$95.15 per VMMC performed, based on a cost assessment of VMMC services aligned with the WHO’s considerations of models for

optimising volume and efficiencies. The VMMC unit cost in Zimbabwe was estimated to be US$78.23 (range US$62.58– US$93.87). Results from the DMPPT models suggest that scaling up adult VMMC to reach 80% coverage in the 13 countries by 2015 would entail performing 20.34 million circumcisions between 2011 and 2015 and an additional 8.42 million between 2016 and 2025 (to maintain the 80% coverage). Such a scale-up would result in averting 3.36 million new HIV infections through 2025.

In Zimbabwe it was estimated that 2.17 million circumcisions between 2011 and 2025 would avert 570,000 HIV infections, 42%. This amounts to four VMMC per HIV infection inverted. The large benefit of VMMC in Zimbabwe is largely driven by the currently low prevalence of VMMC (10.3%) and high HIV prevalence (17.9%) and incidence (2.2%). Cost per HIV infection averted is estimated at US$369.

Net savings associated with VMMC scale-up are estimated. The savings due to future ART costs avoided (with the discounted value of lifetime HIV treatment costs estimated at US$7,400 per infection) minus the discounted VMMC costs amount to US$16,510,000,000 for the 13 countries from 2011 to 2025. The net savings can also be combined with the number of HIV infections averted to obtain the net savings per HIV infection averted. Net savings for Zimbabwe is estimated to be US$7,031 for 2011-2025.

This study suggests that rapid scale-up of VMMC in eastern and southern Africa is warranted based on the likely impact on the region's HIV epidemics and net savings. Scaling up of safe VMMC in eastern and southern Africa will lead to a substantial reduction in HIV infections in the countries and lower health system costs through averted HIV care costs.

Male circumcision at different ages in Rwanda: a cost-effectiveness study
Binagwaho A, Pegurri E, Muita J, & Bertozzi S. (2010) PLOS Medicine 7(1)
http://journals.plos.org/plosmedicine/article?id=10.1371/journal.pmed.1000211

There is strong evidence showing that male circumcision (MC) reduces HIV infection and other STIs. In Rwanda, where adult HIV prevalence is 3%, MC is not a traditional practice. The Rwanda National AIDS Commission modelled cost and effects of MC at different ages to inform policy and programmatic decisions in relation to introducing MC. This study was necessary because the MC debate in Southern Africa has focused primarily on MC for adults. Further, this is the first time, to our knowledge, that a cost-effectiveness study on MC has been carried out in a country where HIV prevalence is below 5%.

A cost-effectiveness model was developed and applied to three hypothetical cohorts in Rwanda: newborns, adolescents, and adult men. Effectiveness was defined as the number of HIV infections averted, and was calculated as the product of the number of people susceptible to HIV infection in the cohort, the HIV incidence rate at different ages, and the protective effect of MC; discounted back to the year of circumcision and summed over the life expectancy of the circumcised person. Direct costs were based on interviews with experienced health care providers to determine inputs involved in the procedure (from consumables to staff time) and related prices. Other costs included training, patient counselling, treatment of adverse events, and promotion campaigns, and they were adjusted for the averted lifetime cost of health care (antiretroviral therapy [ART], opportunistic infection [OI], laboratory tests). One-way sensitivity analysis was performed by varying the main inputs of the model, and thresholds were calculated at which each intervention is no longer cost-saving and at which an intervention costs more than one gross domestic product (GDP) per capita per life-year gained.

Neonatal MC is less expensive than adolescent and adult MC (US$15 instead of US$59 per procedure) and is cost-saving (the cost-effectiveness ratio is negative), even though savings from infant circumcision will be realised later in time. The cost per infection averted is

US$3,932 for adolescent MC and US$4,949 for adult MC. Results for infant MC appear robust. Infant MC remains highly cost-effective across a reasonable range of variation in the base case scenario. Adolescent MC is highly cost-effective for the base case scenario but this high cost-effectiveness is not robust to small changes in the input variables. Adult MC is neither cost-saving nor highly cost-effective when considering only the direct benefit for the circumcised man.

The study suggests that Rwanda should be simultaneously scaling up circumcision across a broad range of age groups, with high priority to the very young. Infant MC can be integrated into existing health services (i.e. neonatal visits and vaccination sessions) and over time has better potential than adolescent and adult circumcision to achieve the very high coverage of the population required for maximal reduction of HIV incidence. In the presence of infant MC, adolescent and adult MC would evolve into a “catch-up” campaign that would be needed at the start of the program but would eventually become superfluous.

Costs and impacts of scaling up voluntary medical male circumcision in Tanzania
Menon V, Gold E, Godbole R, Castor D, Mahler H, Forsythe S, Ally M and Njeuhmeli E. (2014) PLOS One 9(5):e83925
http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0083925

Given the proven effectiveness of voluntary medical male circumcision (VMMC) in preventing the spread of HIV, Tanzania is scaling up VMMC as an HIV prevention strategy. This study will inform policymakers about the potential costs and benefits of scaling up VMMC services in Tanzania.

The analysis first assessed the unit costs of delivering VMMC at the facility level in three regions—Iringa, Kagera, and Mbeya—via three currently used VMMC service delivery models (routine, campaign, and mobile/island outreach). Subsequently, using these unit cost data estimates, the study used the Decision Makers' Program Planning Tool (DMPPT) to estimate the costs and impact of a scaled-up VMMC program.

Increasing VMMC could substantially reduce HIV infection. Scaling up adult VMMC to reach 87.9% coverage by 2015 would avert nearly 23,000 new adult HIV infections through 2015 and an additional 167,500 from 2016 through 2025—at an additional cost of US$253.7 million through 2015 and US$302.3 million from 2016 through 2025. Average cost per HIV infection averted would be US$11,300 during 2010–2015 and US$3,200 during 2010–2025. Scaling up VMMC in Tanzania will yield significant net benefits (benefits of treatment costs averted minus the cost of performing circumcisions) in the long run—around US$4,200 in net benefits for each infection averted.

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 because VMMC averts infections some years into the future among people who have been circumcised. Given the health and economic benefits of investing in VMMC, the scale-up of services should continue to be a central component of the national HIV prevention strategy in Tanzania.

Costing adult male circumcision in high HIV prevalence, low circumcision rate countries
Fieno JV. AIDS Care 2008;20(5):515-20.
http://www.ncbi.nlm.nih.gov/pubmed/18484318

The dramatic evidence that male circumcision has a substantial effect in preventing HIV infection might be the most important medical finding in the course of the AIDS epidemic since the introduction of highly active antiretroviral therapy (HAART). The transition from clinical trails to implementation of a general adult male circumcision (AMC) programme is beginning, and this paper uses an AMC cost model (in Microsoft Excel) to estimate the cost of a rapid scale-up of an AMC program in Mozambique, a country with a generalised epidemic and low rate of male circumcision.

There are three major findings: (1) Even the most modest of AMC programmes would place great stress on human resources, and task-shifting might lead to more accidents or adverse events that would increase the cost per AMC. (2) The fiscal burden of AMC is surprisingly low, but a rapid scale-up of AMC poses additional fiscal stress for Mozambique's already under-funded public health system. (3) AMC as an HIV prevention tool is very robust in terms of its cost-effectiveness in Mozambique, even at a high AMC accident or complication rate. Any AMC roll-out in Mozambique would face severe constraints in the health system (namely human resources) that would likely limit the scale of an AMC programme and perhaps its effectiveness against its generalised epidemic.

Male circumcision for HIV prevention in sub-Saharan Africa: who, what and when?
White RG, Glynn JR, Orroth KK, Freeman EE, Bakker R, Weiss HA, Kumaranayake L, Habbema JD, Buve A, Hayes RJ. (2008) AIDS, 22 (14): 1841-1850.
http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3207867/

Heterosexual exposure accounts for most HIV transmission in sub-Saharan Africa, and this mode, as a proportion of new infections, is escalating globally. The scientific evidence accumulated over more than 20 years shows that among the strategies advocated during this period for HIV prevention, male circumcision is one of, if not, the most efficacious epidemiologically, as well as cost-wise. Despite this, and recommendation of the procedure by global policymakers, national implementation has been slow. Additionally, some are not convinced of the protective effect of male circumcision and there are also reports, unsupported by evidence, that non-sex-related drivers play a major role in HIV transmission in sub-Saharan Africa.

Here, the authors provide a critical evaluation of the state of the current evidence for male circumcision in reducing HIV infection in light of established transmission drivers, provide an update on programmes now in place in this region, and explain why policies based on established scientific evidence should be prioritised. They conclude that the evidence supports the need to accelerate the implementation of medical male circumcision programmes for HIV prevention in generalised heterosexual epidemics, as well as in countering the growing heterosexual transmission in countries where HIV prevalence is presently low.

Significant reduction in HIV prevalence according to male circumcision intervention in sub-Saharan Africa
Londish GJ, Murray JM. (2008) Int J Epidemiol 37(6):1246-1253.
http://ije.oxfordjournals.org/content/37/6/1246.full

Observations that reduced adult HIV prevalence in sub-Saharan Africa correlated with levels of MC, have suggested that MC could be used as a preventative measure against HIV

infection. The exact benefits of this intervention are uncertain. Moreover if MC is not feasible for the whole male population, which groups should be targeted?

A mathematical model simulated observed levels of HIV prevalence under the complete range of current levels of circumcision. Increased MC from 2007 was incorporated in this model and used to simulate HIV prevalence in 2020.

Complete coverage by MC could reduce HIV prevalence from 12 to 6% for an average population country in sub-Saharan Africa in 2020. This reduction is scaled proportionally when lower circumcision levels are achieved. These benefits are achieved mostly by circumcising men between 20 and 30 years of age (adult prevalence reduced from 12 to 10%), and those with riskier behaviour (8 to 6.9%). Complete negation of these benefits requires at least 40% of circumcised males to significantly increase risky behaviour.

MC provides an effective intervention in sub-Saharan Africa to reduce HIV prevalence. It is most effective when applied to 20–30 year old risky males with diminishing returns with application to the wider male population.

3. USAID reports

Costing male circumcision in Swaziland and implications for the cost-effectiveness of circumcision as an HIV prevention intervention
Martin G, Bollinger L, Pandit-Rajani T, Nkambula R, and Stover J. (2007a). USAID, The Health Policy Initiative.
http://www.healthpolicyinitiative.com/Publications/Documents/412_1_Swaziland_MC_Costing_FINAL.pdf

The purpose of the analysis in Swaziland was to understand the social, cultural, and policy context of male circumcision; assess the cost of providing adult MC in a resource-constrained setting; and evaluate the implications of scaling up MC for the cost-effectiveness of MC and for the health system (e.g. resource mobilisation and health system capacity). The research used a qualitative analysis, a cost analysis, and epidemiological modelling.

Uncomplicated circumcisions usually require four visits: an initial visit for the pre-surgical examination and information and education; a second visit for the surgical procedure; and two follow-up visits at 2-3 and 7 days post-surgery. A fifth visit at 21 days post-surgery is recommended but seldom occurs in uncomplicated cases. Adult MC is done under local anaesthesia. Antibiotics are not routinely prescribed by providers. Dressings are generally not reapplied at the first post-operative visit (although this was not the case in Lesotho and some providers in Zambia).

The unit cost of a comprehensive package of MC services was estimated at U$51.30 (weighted for the cost of complications). The largest share of this amount was surgical costs (78.6%), followed by communications (14.5%), testing (3.6%), and pre-and post-operative counselling (3.3%). Note that this excludes training, community mobilisation and policy analysis and formulation costs. Based on the cost analysis, the epidemiological impact and cost effectiveness of scaling up MC among males (ages 15–49) to 57.5 percent coverage (i.e. to reduce the number of uncircumcised men by half) between 2008 and 2020 were projected for Swaziland. It was estimated that one HIV infection will be averted for every 4.1 circumcisions performed and that the cost per infection averted is US$176.

Relative to other prevention interventions, MC is potentially a cost-effective intervention. The cost-effectiveness analysis depends on several factors: (1) the period over which the cost-effectiveness analysis is estimated and (2) the pace of scaling up. These findings are largely

because MC is a one-time intervention and because there are direct and indirect effects associated with MC. The benefits of male circumcision are therefore multiplicative over time.

How sensitive are the cost-effectiveness results to assumptions about behavioural responses to MC? The impact of changes in condom use on cost per infection averted showed that the results are relatively insensitive to small to moderate reductions. For example, the impact of male circumcision would be less than shown here if those who are circumcised adopt riskier behaviours because they think they are protected by the circumcision. A 25 percent reduction in condom use among those who are circumcised would reduce the impact by about 17 percent in Swaziland. As the qualitative analysis also reveals, these results underscore the critical importance of (1) locating the surgical provision of MC within a comprehensive set of services that includes behaviour change communications and pre- and post-operative counselling; and (2) locating MC services within a broader set of effective prevention interventions.

The scaling up requires approximately 14,644 male circumcisions in 2008, increasing to a high of 18,305 in 2015—implying an average annual number of 11,297 circumcisions or a daily average of 47 circumcisions for the next 10 years to achieve and maintain 57.5 percent coverage. Over the period 2008– 2020, on average, 4.5 surgical nurses and 6.1 physicians have to be dedicated full time to male circumcision. According to the WHO, there are 171 physicians in the public and private health system of Swaziland, implying that 4 percent of all doctors will be required to reach this relatively modest scale-up target. The cumulative total resources needed for scaling up MC between 2008 and 2020 is US$6.6 million. The average annual cost is US$506,061. As expected, the surgical procedure accounts for the overwhelming share of the total costs (78.6%), followed by communications (14.5%). As mentioned before, training, community mobilisation, and policy analysis and formulation costs are not included in this estimate.

There are several factors that influence the potential benefits. The pace of scaling up matters and the benefits from scaling up are not only multiplicative but also long lasting. In addition, it is important to provide the surgical procedure within a comprehensive set of services that includes behaviour change communications and pre- and post-operative counselling and, equally important, to provide MC services within a broader set of effective prevention interventions.

The analysis also showed that the implications to the health system are not trivial. The intention is not to suggest that vast increases in service delivery capacity (in terms of surgical facilities or surgical staff) are necessarily needed in Swaziland. Rather, it is recommended that some innovative ways be identified to involve all providers of clinical services. One issue to consider is that public and private provision of MC can be complementary and should not be viewed as mutually exclusive. However, mechanisms should be devised to align practices among private providers with the recommended approaches (routine use of general anaesthesia; routine prescription of antibiotics), allowing for standardisation of the procedure across all health institutions in the country.

The positive externalities associated with MC have been established and lay the basis for justifying public subsidisation. However, the specific provider payment methods need to be decided on (e.g. fee-for-service; capitation approaches), as well as the mechanisms of reimbursement (voucher mechanisms, contracting, etc.). The health service, financial, and human resource implications are significant but not insurmountable; taking them into account will be important in ensuring that the benefits of this important public health intervention are realised as soon as possible by the people of Swaziland.

Costing male circumcision in Zambia and implications for the cost-effectiveness of circumcision as an HIV intervention
Martin G, Bollinger L, Pandit-Rajani T, Forsythe S, & Stover J. (2007b). USAID Health Policy Initiative.
http://pdf.usaid.gov/pdf_docs/Pnadp248.pdf

The purpose of this analysis in Zambia was to assess the cost of providing adult MC in resource-constrained settings and to evaluate the implications of scaling up MC for the cost-effectiveness of MC and for the health system (e.g. resource mobilisation and health system capacity).

Uncomplicated circumcisions usually require four visits: an initial visit for the pre-surgical examination and information and education; a second visit for the surgical procedure; and two follow-up visits at 2 and 7 days post-surgery. A fifth visit at one month post-surgery is recommended but seldom occurs in uncomplicated cases. Adult MC is done under local anaesthesia. Antibiotics are not routinely prescribed by providers. Dressings are generally not reapplied at the first post-operative visit (although this was not the case in Lesotho and some providers in Swaziland).

The unit cost of a comprehensive package of MC services was estimated at US$46.82 (weighted for the cost of complications). The largest share of this amount was surgical costs (76.5%), followed by communications (15.9%), testing (3.9%), and pre-and post-operative counselling (3.6%). Note that this excludes training, community mobilisation, and policy analysis and formulation costs. Based on the cost analysis, the epidemiological impact and cost effectiveness of scaling up MC among males (ages 15–49) to 58.5 percent coverage (i.e. to reduce the number of uncircumcised men by half) between 2008 and 2020 were projected for Zambia. It was estimated that one HIV infection will be averted for every 8.0 circumcisions performed and that the cost per infection averted is US$313. Relative to other prevention interventions, MC is potentially a cost-effective intervention. The cost-effectiveness analysis depends on several factors: (1) the period over which the cost-effectiveness analysis is estimated and (2) the pace of scaling up. These findings are largely because MC is a one-time intervention and because there are direct and indirect effects associated with MC. The benefits of male circumcision are therefore multiplicative over time.

How sensitive are the cost-effectiveness results to assumptions about behavioural responses to MC? The impact of changes in condom use on cost per infection averted showed that the results are relatively insensitive to small or moderate reductions. For example, the impact of male circumcision would be less than shown here if those who are circumcised adopt riskier behaviours because they think they are protected by the circumcision. A 25 percent reduction in condom use among those who are circumcised would reduce the impact by about 20 percent. These results underscore the critical importance of (1) locating the surgical provision of MC within a comprehensive set of services that includes behaviour change communications and pre- and post-operative counselling; and (2) locating MC services within a broader set of effective prevention interventions.

The scaling up requires approximately 168,293 male circumcisions in 2008, increasing to a high of 264,388 in 2015. As previously mentioned, it is assumed that the percent of men circumcised would remain at the same level beyond 2015. Hence, by 2020, an average annual number of 167,377 circumcisions or a daily average of 697 circumcisions will be required over the next decade to achieve and maintain 58.5 percent coverage. The cumulative total resources needed for scaling up MC between 2008 and 2020 is US$84.9 million. The average annual cost is US$6.5 million. As expected, the surgical procedure accounts for the overwhelming share of the total costs (76.5%), followed by communications (15.9%). As mentioned before, training, community mobilisation, and policy analysis and formulation costs are not included in this estimate.

The analysis has shown that MC can be a cost-effective intervention when compared to the relative cost effectiveness of other prevention interventions. There are several factors that influence the potential benefits. The pace of scaling up matters and the benefits from scaling up are not only multiplicative but also long lasting. In addition, it is important to provide the surgical procedure within a comprehensive set of services that includes behaviour change communications and pre- and post-operative counselling and, equally important, to provide MC services within a broader set of effective prevention interventions.

The analysis also showed that the implications to the health system are not trivial. The intention is not to suggest that vast increases in service delivery capacity (in terms of surgical facilities or surgical staff) are necessarily needed in Zambia. Rather, it is recommended that some innovative ways be identified to involve all providers of clinical services. One issue to consider is that public and private provision of MC can be complementary and should not be viewed as mutually exclusive. However, mechanisms should be devised to align practices among private providers with the recommended approaches (routine use of general anaesthesia; routine prescription of antibiotics), allowing for standardisation of the procedure across all health institutions in the country. The positive externalities associated with MC have been established and lay the basis for justifying public subsidisation. However, the specific provider payment methods need to be decided on (e.g. fee-for-service; capitation approaches), as well as the mechanisms of reimbursement (voucher mechanisms, contracting, etc.). The health service, financial, and human resource implications are significant but not insurmountable; taking them into account will be important in ensuring that the benefits of this important public health intervention are realised as soon as possible by the people of Zambia.

Costing male circumcision in Lesotho and implications for the cost-effectiveness of circumcision as an HIV intervention
Martin G, Bollinger L, Pandit-Rajani T, Tshehlo R, & Stover J. (2007c). USAID.
http://www.healthpolicyinitiative.com/Publications/Documents/410_1_Lesotho_MC_Costing_FINAL_10_11_07.pdf

The purpose of the analysis in Lesotho was to (1) understand the social, cultural, and policy context of male circumcision; (2) assess the cost of providing adult MC in a resource-constrained setting; and (3) evaluate the implications of scaling up MC for the cost-effectiveness of MC and for the health system (e.g. resource mobilisation and health system capacity).

Uncomplicated circumcisions usually require four visits: an initial visit for the pre-surgical examination and information and education; a second visit for the surgical procedure; and two follow-up visits at 2–3 and 7 days post-surgery. A fifth visit at 21 days post-surgery is recommended but seldom occurs in uncomplicated cases. Adult MC is done under local anaesthesia by all except private providers, who usually use general anaesthesia. Waiting time between the first and second visit ranges from 1–8 weeks. Antibiotics are routinely prescribed by providers but not by all providers. Dressings are generally reapplied at the first post-operative visit (although this was not the case in Swaziland and Zambia). The cost to the patient using non-private providers ranged between US$4.10 and US$8.30.

The unit cost of a comprehensive package of MC services was estimated at $56.35 (weighted for the cost of complications). The largest share of this amount was surgical costs (81%), followed by communications (13%), testing (3%), and pre-and post-operative counselling (3%). Note that this excludes training, community mobilisation, and policy analysis and formulation costs. Based on the cost analysis, the epidemiological impact and cost effectiveness of scaling up MC among males (ages 15–49) to 52.5 percent coverage between 2008 and 2020 were projected for Lesotho. It was estimated that one HIV infection will be averted for every 6.1 male circumcisions performed and that the cost per infection

averted is US$292. Relative to other prevention interventions, MC is potentially a cost-effective intervention. The cost-effectiveness analysis depends on several factors: (1) the period over which the cost-effectiveness analysis is estimated and (2) the pace of scaling up. These findings are largely because MC is a one-time intervention and there are direct and indirect effects associated with MC. The benefits of male circumcision are therefore multiplicative over time.

How sensitive are the cost-effectiveness results to assumptions about behavioural responses to MC? The impact of changes in condom use on cost per infection averted showed that the results are relatively insensitive to small or moderate reductions. For example, the impact of male circumcision would be less than what is presented here if those who are circumcised adopt riskier behaviours because they think they are protected by the circumcision. A 25 percent reduction in condom use among those who are circumcised would reduce the impact by about 7 percent. These results underscore the critical importance of (1) locating the surgical provision of MC within a comprehensive set of services that includes behaviour change communications and pre- and post-operative counselling; and (2) locating MC services within a broader set of effective prevention interventions.

The scaling up of MC requires approximately 34,798 male circumcisions in 2008, increasing to a high of 44,164 in 2015—implying an average annual number of 27,473 circumcisions or a daily average of 114 circumcisions for the next 10 years to achieve and maintain 52.5 percent coverage. Over the period 2008– 2020, on average, 9.1 surgical nurses and 10.9 physicians have to be dedicated full time to male circumcision. According to the WHO, there are 89 physicians in the public and private health system of Lesotho, implying that more than a tenth (12.2%) of all doctors will be required to reach this relatively modest scale-up target. The cumulative total resources needed for scaling up MC between 2008 and 2020 is US$17.2 million (M125.9 million). The average annual cost is US$1.3 million (M9.6 million). As expected, the surgical procedure accounts for the overwhelming share of the total costs (81%), followed by communications (13%). As mentioned before, training, community mobilisation, and policy analysis and formulation costs are not included in this estimate.

The analysis has shown that MC can be a cost-effective intervention when compared to the relative cost effectiveness of other prevention interventions. There are several factors that influence the potential benefits. The pace of scaling up matters and the benefits are not only multiplicative but also long lasting. In addition, it is important to provide the surgical procedure within a comprehensive set of services that includes behaviour change communications and pre- and post-operative counselling and, equally important, to provide MC services within a broader set of effective prevention interventions.

The analysis also showed that the implications to the health system are not trivial. The intention is not to suggest that vast increases in service delivery capacity (in terms of surgical facilities or surgical staff) are necessarily needed in Lesotho. Rather, it is recommended that some innovative ways be identified to involve all providers of clinical services. One issue to consider is that public and private provision of MC can be complementary and should not be viewed as mutually exclusive. However, mechanisms should be devised to align practices among private providers with the recommended approaches (routine use of general anaesthesia, routine prescription of antibiotics), allowing for standardisation of the procedure across all health institutions in the country. The positive externalities associated with MC have been established and lay the basis for justifying public subsidisation. However, the specific provider payment methods need to be decided on (fee-for-service, capitation approaches), as well as the mechanisms of reimbursement (voucher mechanisms, contracting, etc.). The health service, financial, and human resource implications are significant but not insurmountable; taking them into account will be important in ensuring that the benefits of this important public health intervention are realised as soon as possible by the people of Lesotho.

Male circumcision: Decision makers' program planning tool, calculating the costs and impacts of a male circumcision program
Bollinger L, DeCormier Plosky W, and Stover J. (2009) USAID Futures Group, Health Policy Initiative, Task Order 1.
https://www.malecircumcision.org/sites/default/files/document_library/DMPPT_manual_web_1202010_0.pdf

The Male Circumcision: Decision Makers' Program Planning Tool is designed to support policy development and planning for scaling up the provision of safe MC services. It enables analysts and decision makers to understand the costs and impacts of policy options. It is a part of a 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 main policy areas addressed by the model are the following:

- Priority populations: all male adults, young adults, adolescents, newborns, and most-at-risk groups
- Target coverage levels and rates of scale-up
- Service delivery modes: hospital, clinic, mobile van; public, private, nongovernmental organisation, and "other"
- Task shifting

This training manual is designed to introduce participants to the basics of the MC Model, how to set it up, and how to interpret the results.

The MC Model contains two sub-models: 1. The costing model 2. The impact model.

4. Additional information

Author
This query response was prepared by **Laura Bolton**