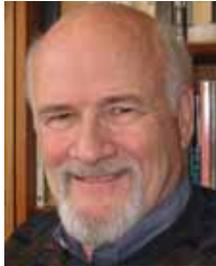


Male circumcision is *not* the HIV 'vaccine' we have been waiting for!



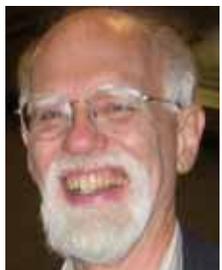
'Thousands of African men now line up to get circumcised in the mistaken belief that it will save them from HIV...'



Over the past several months, some researchers and health organizations [101] have proclaimed circumcision to be a compelling and important new HIV tool. A recent commentary claims that circumcision is "at least as good as the HIV vaccine we have been waiting for, praying for and hoping to see in our lifetimes" [1]. Thousands of African men now line up to get circumcised in the mistaken belief that it will save them from HIV, as some developing nations – lacking even rudimentary medical care and clean drinking water – rush to implement mass circumcision programs with encouragement and millions of pledged dollars from the US government [2,102,103]. In addition, there are calls for implementing mass neonatal circumcision [104].



The push to institute mass circumcision in Africa, following the three randomized clinical trials (RCTs) conducted in Africa [3–5], is based on an incomplete evaluation of real-world preventive effects over the long-term – effects that may be quite different outside the research setting and circumstances, with their access to resources, sanitary standards and intensive counseling. Moreover, proposals for mass circumcision lack a thorough and objective consideration of costs in relation to hoped-for benefits. No field-test has been performed to evaluate the effectiveness, complications, personnel requirements, costs and practicality of proposed approaches in real-life conditions. These are the classic distinctions between efficacy and effectiveness trials, and between internal validity and external validity [6].



**Lawrence W Green,
Ryan G McAllister,
Kent W Peterson &
John W Travis[†]**

[†] Author for correspondence
Wellness Associates,
PO Box 8422, Asheville,
NC 28814, USA
Tel.: +1 206 984 0948;
Fax: +1 206 984 0948;
jwtravis@mindspring.com

Campaigns to promote safe-sex behaviors have been shown to accomplish a high rate of infection reduction [7], without the surgical risks and complications of circumcision, and at a much lower cost. For the health community to rush to recommend a program based on incomplete evidence is both premature and ill-advised.

It misleads the public by promoting false hope from uncertain conclusions and might ultimately aggravate the problem by altering people's behavioral patterns and exposing them and their partners to new or expanded risks [8]. Given these problems, circumcision of adults, and especially of children, by coercion or by false hope, raises human rights concerns.

Insufficient data for a real-world setting
The three African RCTs reported a 50–60% reduction in female-to-male transmission of HIV over follow-up periods of 21–24 months. It is beyond the scope of this paper to analyze these studies in depth. However, the world health community must examine the methodology and results of these studies much more carefully than it has done so far. Given that these studies are now being used to promote circumcision of millions of males, it is worth examining several other factors that might have influenced and skewed the results:

- All three of the studies were halted early
- The durations of the experiments were short
- No long-term follow-up has been or can be done
- A large number of participants were lost to follow-up
- Many infections appear to be from nonsexual sources [9]
- Other important confounding factors exist

Early termination

The early termination of the RCTs raises methodological problems that may have biased the results and the conclusions drawn from them. A systematic review of RCTs stopped early based on interim results found that treatment effects are often overestimated [10]. AIDS experts have expressed concern that the overall cases in the Auvert study were low enough to render the results at "serious risk of overestimation" [11].

There is no way to know if the short-term results of the trials would have continued. In the Kenya trial, the protective effect of circumcision seemed to disappear after 18 months. In the 18–24-month follow-up period, eight circumcised

and nine uncircumcised males contracted HIV, an insignificant difference. The question of whether the interventional effect would have continued to be insignificant past 18 months can never be answered. Furthermore, since the control group participants were all offered circumcision at the termination of the RCTs, all possibility for long-term follow-up was eliminated. Lead time bias, in which circumcised men likely have fewer seroconversions in the first weeks owing to their inability to have sex in the post-operative period, is exaggerated in early termination studies.

'...proposals for mass circumcision lack a thorough and objective consideration of costs in relation to hoped-for benefits.'

Participant loss

The number of participants lost to follow-up is potentially problematic. Typically, attrition of a small portion of participants is not a cause for concern, but in these trials, the number lost was far greater than the number who contracted HIV. A total of 10,908 males were initially enrolled in the three clinical trials, 5497 in the control (uncircumcised) groups and 5411 in the intervention (circumcised) groups. By the end of the RCTs, a total of 64 circumcised and 141 uncircumcised males had contracted HIV. During the trials, a total of 703 participants, including similar numbers of circumcised and uncircumcised men, were lost to follow-up, their HIV status unknown. Depending on the HIV status of the males lost to follow-up, the statistical significance of the trial results could vary greatly [3–5].

Nonsexual transmission

Another problem in the RCTs is the large proportion of HIV infections that study participants contracted from nonsexual risks. According to the reported sexual behavior of the males in the Orange Farm trial, 23 of the 69 infections occurred in men who reported no unprotected sex during the observation interval. Similarly, in the Uganda trial, 16 of the 67 infections occurred in men who reported either no sex partners or 100% condom use. The trial in Kenya did not provide data on sexual exposures as related to HIV incidence. The proportion of nonsexual transmission in participants suggests that circumcision may not have the impact on the HIV crisis that is being promoted [9], and, indeed, could be contributing to the infections.

Conflicting results

Prior to the three RCTs, observational studies of HIV in relation to circumcision status showed conflicting results. This should caution the world health community to question the RCTs' unanimous conclusions. Recent survey data of circumcised versus uncircumcised males in several African countries show considerable variation in HIV rates. In some African populations, HIV infection rates are lower for circumcised males, while other studies and reports have shown opposite results [8,12,105]. For example, the 2005 survey data for Rwanda show an HIV-infection rate of 3.8% in circumcised men and only 2.7% in uncircumcised men [106]. Data for Malawi in 2004 show a 13% HIV-infection rate in circumcised males, but a lower 9.5% infection rate in uncircumcised males [9,107]. Clearly, circumcision status is not the only or determining factor in HIV prevalence patterns.

Sex workers

Accounting for the number of HIV-infected commercial sex workers in a region, circumcision status appears to become an irrelevant factor [13]. African regions with prominent Muslim populations tend to have high rates of circumcision and low rates of prostitution. The latter may account for lower HIV-infection rates previously attributed to circumcision. The role of commercial sex workers and concurrent sexual networks, a much more plausible infection vector than the possession of a foreskin, has not been adequately taken into consideration in plans to stop the epidemic [13–15].

Lack of risk calculation

Another concern about the three RCTs is the failure of the study teams to report the results in a way that compared HIV incidence per sexual exposure between the circumcised and uncircumcised populations. Per-incident risk calculation is necessary in order for men to weigh potential expected benefits from the surgery, based on anticipated sexual behaviour, against the risks and costs of circumcision. Without this information, men cannot be said to have given fully informed consent [9].

Other unconsidered factors

Other factors and conditions were present in the three RCTs that are not representative of the real world, potentially influencing the study results. These include the following:

- Condom use and safe-sex practices were repeatedly reinforced
- Participants were provided 2 years of free medical care
- Participants were paid to participate
- Participants were solicited who wanted to be circumcised, and who may, therefore, not be representative of the general population
- The trials were conducted in atypically sanitary and well-resourced settings that are unlikely to be replicated in mass African circumcision campaigns

Circumcision could lead to increased HIV transmission

A recent study showed that female partners of newly circumcised HIV-positive males had a significantly increased risk of contracting HIV [16]. In Uganda, health officials do not have the resources to test for HIV in the men they plan to circumcise [108]. Mass circumcision of adults without HIV testing could increase the risk of HIV transmission to females.

Circumcision itself is known to spread HIV in Africa via contaminated medical instruments. One study estimates that circumcision increases the chance of infection by 300% [17]. Mass circumcision campaigns are not likely to have the same level of operator training or sanitary conditions as the clinical trials. For countries with limited economic resources to provide circumcision in a medical setting, these campaigns will encourage the inevitable 'bush' circumcision market. Regardless of the ratio between clinic and 'bush' situations, both could ultimately increase HIV transmission.

If the men in the three RCTs accurately reported their sexual behavior, many infections must have come from blood exposures, not sexual contact. Instituting mass surgery could further exacerbate the transmission of HIV through blood exposures in the clinics and hospitals where circumcisions will occur. Rather than promoting circumcisions, an alternate strategy to cut HIV incidence may be to improve infection control in hospitals and clinics [9].

Furthermore, promotion of circumcision as a method to prevent or reduce HIV transmission may already be leading circumcised men, and their sexual partners, into a false sense of security about being protected or immune from HIV. This, in turn, could undermine the current and effective 'abstinence, be faithful and condom use' (ABC) campaigns [18,19]. The RCTs reported no

evidence of risk compensation behaviors during the study period. However, the study participants were receiving intensive counseling, free condoms and continuous monitoring during this period, circumstances that will most likely not exist in mass circumcision campaigns. Despite agreement that safe-sex messages must be built into circumcision campaigns, reports are already appearing that African males are indeed absorbing the message that circumcision means protection and other measures to prevent HIV are unnecessary [109]. Such potential risk-compensation behavior after circumcision has been inadequately studied in real-life settings over the long term. The likely result of promoting circumcision for HIV-risk reduction is that it will not complement condom use, as proponents hope, but, in reality, it will compete with condom use. It could not only negate any hoped-for protection from circumcision, but message confusion among Africans could lead to a dangerous erosion of behavioral gains already made in safe-sex campaigns.

'Campaigns to promote safe-sex behaviors have been shown to accomplish a high rate of infection reduction, without the surgical risks and complications of circumcision, and at a much lower cost.'

Finally, shifting attention and resources to circumcision messages takes resources away from proven behavioral prevention methods and efforts to upgrade Africa's health infrastructure. By focusing on short-sighted surgical solutions, valuable time and resources are diverted from addressing the root problems of HIV transmission.

The French Conseil National du SIDA (National AIDS Council) recently issued a statement that sums up most of the above concerns: "Implementation of male circumcision as part of a raft of preventive measures could destabilize healthcare delivery and at the same time confuse existing prevention messages. The addition of a new 'tool' could actually cause a result opposite to that which was originally intended" [20].

Circumcision costs & harms outweigh potential benefits

Very little attention is being given to the surgical complications associated with circumcision or the cost of treating these complications. Even if mass circumcision campaigns produce complication rates similar to the extraordinarily low

complication rates in the RCTs, which is unlikely, tens of thousands of African males will still suffer from them. A more realistic complication rate of 20.2% was documented in a study of Nigerian neonates circumcised by medical practitioners [21]. A true cost–benefit analysis cannot be carried out without accurate complication rates. Estimates of the cost of complications are likely to mushroom with the inclusion of infection rates in unsanitary conditions, need for repeat surgeries for poorly performed circumcisions and treatment of inflammation of the urinary meatus leading to stenosis (occurring in up to 10% of circumcised males) [110].

‘Recent evidence demonstrates that the Langerhans cells in the foreskin have a protective effect against pathogens, including HIV, by producing the protein langerin.’

While it is not possible to make a direct comparison of the cost of condoms versus the cost of circumcision, it is worthwhile to consider the significant cost discrepancies between these two strategies. In the RCTs, circumcisions were performed at a cost of approximately US\$69 each [22]. Condoms cost three cents each [111]. African males require an average of 84 condoms per year [23]. For the cost of one circumcision, which, according to the RCTs, might be 50% effective, a man could receive a 32-year supply of condoms and protect himself and his partner(s) 87–100% of the time [24].

The millions of dollars that would be directed toward circumcision could have a far greater impact on health outcomes in Africa if used toward promoting safe-sex campaigns, HIV testing, provision of antiretrovirals and other core public health needs.

Unethical medical practice

Furthermore, the results of studies performed on consenting adult African males should not be extrapolated to a health policy for newborns. It is unprecedented and unethical for an inadequately evaluated prophylactic surgery to be offered as a ‘health benefit’ to parents of newborns to reduce risks of an adult-acquired disease for which alternative preventatives, in addition to condoms, are likely to be available before today’s infants reach sexual maturity [25].

Newborns are not sexually active and, therefore, not at risk for sexually contracted diseases. Ethically and according to human rights law,

circumcising an unconsenting child is in many ways similar to forcing circumcision upon an unwilling adult. Children deserve special protection from practices that put them at unnecessary risk and abrogate their rights to self-determination in the future.

More effective prevention strategies available

If all African adult males were immediately circumcised (and its effectiveness were the same as reported in the RCTs), over the next 10-year period, it would reduce the number of HIV cases in sub-Saharan Africa by only 8%, with a 1% reduction of deaths [26]. There are better, more cost effective and less risky strategies available.

Education, safe-sex practices and consistent condom use are proven, effective measures for curbing HIV transmission [27]. Uganda, Senegal and Thailand have successfully lowered their HIV-infection rates without resorting to surgery. For example, HIV prevalence declined in Uganda by 47% following increased safe-sex education and condom promotion [7]. This ‘social vaccine’ is available and effective now and does not entail the complications of surgery. Uganda was successful in part because of leadership; leadership in other quarters can extend this success elsewhere. Thailand’s success was with the highest risk group (prostitutes), and the strategy only needs extension to other segments of the population. These models emphasize the importance of tackling the behaviors that lead to HIV infection. Continuing to put time and money into effective programs, just as these countries did, is what will be most effective in the long-term, not the promotion of circumcision [112,113].

Vaccine analogy is misleading

Comparing male circumcision to a ‘vaccine’ is misleading, as it plays on the general perception that vaccines offer near-complete protection from an illness with few side-effects. This ‘vaccine’ claim gives a false sense of security because individuals who engage in high-risk behaviors will be at high risk for HIV infection, whether they are circumcised or not. If a pharmaceutical HIV vaccine was available and was only 50–60% effective and likely to decrease condom use and other safe-sex practices, it would not be acceptable because it could increase the HIV-infection rate by altering behavioral patterns [8].

The erroneous message of protection from circumcision given to African males is alarming and dangerous. Dr Robert Bailey, one of the

RCT authors, was recently quoted as saying, “[Circumcision is] the most effective prevention method we know about for heterosexual guys, if it’s done properly” [114]. With statements like this in the news, it is easy to understand why some males may mistakenly conclude that if they are circumcised, they no longer need to use condoms.

Other countervailing data

A recent study in the USA, examining HIV rates in both heterosexual and homosexual populations, found no statistical difference in HIV rates among circumcised and uncircumcised males in either group [28]. Another recent US study evaluating HIV infections in high-risk populations also found no benefit from circumcision [29]. The USA, where the majority of adult males are circumcised, has a much higher HIV-infection rate than European nations, where circumcision is rarely practiced [115].

Recent evidence demonstrates that the Langerhans cells in the foreskin have a protective effect against pathogens, including HIV, by producing the protein langerin. The previous theory was that Langerhans cells are a key entrance point for HIV-1. Circumcision, it was argued, protected against HIV disease because removing the foreskin also removed the Langerhans cells. However, it has now been shown that langerin transports HIV-1 to locations within the Langerhans cell where the virus is destroyed. The authors of this study argue that “strategies to combat infection must enhance, preserve or, at the very least, not interfere with langerin expression and function” [30]. It is only when the Langerhans cells are overwhelmed by a high viral load that the virus can enter the body.

This immunological function of the foreskin may explain the results of recent vaccine trials in which uncircumcised men were more likely to get infected after receiving the vaccine. The authors of the vaccine study speculate “the vaccine was abrogating some immune mechanism that normally protected uncircumcised ‘tops’ (referring to men who have sex with men) from infection through the mucosa of the foreskin” [116].

Conclusion

Regardless of whether circumcision might offer some heterosexual males a partial degree of protection from HIV, numerous other issues need to be thoroughly considered before instituting mass circumcision campaigns.

In short, given the large number of unknowns, confounding factors and lack of long-term follow-up in the three RCTs, it is premature to recommend circumcision as an HIV-prevention strategy. Much more evidence must be gathered on real-world efficacy of male circumcision as a prevention tool before mass surgeries are implemented.

An objective scientific assessment must be conducted to determine if the three RCTs are applicable in real-world settings. And, to determine the true cost of a circumcision campaign, there must be a comprehensive resource analysis of the plan. These mass circumcision costs also must be compared with the opportunity costs of funding ABC campaigns.

‘The world community must cautiously review and carefully consider the long-term consequences of mass circumcision campaigns.’

As part of these assessments, the very real risks of circumcision surgery, including directly increasing HIV transmission to men as well as indirectly increasing transmission to women, surgical risks such as hemorrhage, other infections, meatal stenosis, need for repeat surgery and even death, must be considered.

Finally, the value and function of the foreskin as an integral part of the male sexual organ [31] and the ethical issues surrounding such surgery, including informed consent, the possibility of coercion and the dangerous implications of conveying erroneous messages of HIV immunity, must also be carefully considered in any analysis.

ABC programs offer nearly full protection from HIV infection, yet even if circumcision’s effectiveness matches the 50–60% effectiveness the RCTs reported, it only partially protects men, does not protect women at all, and leaves women more vulnerable to unsafe sex practices being forced upon them.

Those promoting circumcision argue that circumcision is an additional tool that will ultimately reduce infections more than just relying on condoms, monogamy and abstinence. However, African males are already lining up to be circumcised, thinking they will no longer need to use condoms. Rather than complementing ABC programs, promoting circumcision will undermine the ABC approach by diverting funds and encouraging risk compensation behavior, ultimately leading to an increase in HIV infections.

The world community must cautiously review and carefully consider the long-term consequences of mass circumcision campaigns, from the risk of increasing deaths and infections to human rights violations. In the rush to save lives, many may instead be lost and human rights trampled in the stampede. Circumcision is not the panacea the world has been waiting for in the battle to stem the HIV crisis.

Financial & competing interests disclosure

The authors have no relevant affiliations or financial involvement with any organization or entity with a financial interest in or financial conflict with the subject matter or materials discussed in the manuscript. This includes employment, consultancies, honoraria, stock ownership or options, expert testimony, grants or patents received or pending, or royalties.

No writing assistance was utilized in the production of this manuscript.

Bibliography

- Klausner JD, Wamai RG, Bowa K, Agot K, Kagimba J, Halperin DT: Is male circumcision as good as the vaccine we've been waiting for? *Future HIV Ther.* 2(1), 11–17 (2008).
- Timberg C: Choosing survival over culture: in Kenya a tribe considers circumcision to reduce the death toll from AIDS. *Washington Post National Weekly Edition* 17–23 September (2007).
- Auvert B, Taljaard D, Lagarde E, Sobngwi-Tambekou J, Sitta R, Puren A: Randomized, controlled intervention trial of male circumcision for reduction of HIV infection risk: the ANRS 1265 trial. *PLoS Med.* 2(11), e2 (2005).
- Bailey RC, Moses S, Parker CB *et al.*: Male circumcision for HIV prevention in young men in Kisumu, Kenya: a randomised controlled trial. *Lancet* 369(9562), 643–656 (2007).
- Gray RH, Kigozi G, Serwadda D *et al.*: Male circumcision for HIV prevention in men in Rakai, Uganda: a randomised trial. *Lancet* 369(9562), 657–666 (2007).
- Green LW, Glasgow RE: Evaluating the relevance, generalization, and applicability of research: issues in external validation and translation methodology. *Eval. Health Prof.* 29(1), 126–153 (2006).
- Low-Beer D, Stoneburner RL: Behaviour and communication change in reducing HIV: is Uganda unique? *Afr. J. AIDS Res.* 2(1), 9–21 (2003).
- Garenne M: Male circumcision and HIV control in Africa. *PLoS Med.* 3(1), 78 (2006).
- Gisselquist D: Points to consider: responses to HIV/AIDS in Africa, Asia, and the Caribbean. Adonis and Abbey, London, UK 36–37 (2008).
- Montori VM, Devereaux PJ, Adhikari NK *et al.*: Randomized trials stopped early for benefit: a systematic review. *JAMA* 294, 2203–2209 (2005).
- Mills E, Siegfried N: Cautious optimism for new HIV/AIDS prevention strategies. *Lancet* 368, 1236 (2006).
- Mishra V, Vaessen M, Boerma JT *et al.*: HIV testing in national population-based surveys: experience from the Demographic and Health Surveys. *Bull. World Health Organ.* 84(7), 537–545 (2006).
- Talbott JR: Size matters: the number of prostitutes and the global HIV/AIDS pandemic. *PLoS One* 2(6), e543 (2007).
- Chin J: *The AIDS Pandemic: The Collision of Epidemiology with Political Correctness*. Radcliffe Publishing, Oxford, UK (2007).
- Epstein H: *The Invisible Cure*. Farrar, Straus, and Giroux, NY, USA (2007).
- Wawer M, Kigozi G, Serwadda D *et al.*: Trial of circumcision in HIV+ men in Rakai, Uganda: effects in HIV+ men and women partners. Presented at: *15th Conference on Retroviruses and Opportunistic Infections*. Boston, MA, USA, 3–6 February 2008 (Abstract 33LB).
- Brewer DD, Potterat JJ, Roberts JM Jr *et al.*: Male and female circumcision associated with prevalent HIV infection in virgins and adolescents in Kenya, Lesotho, and Tanzania. *Ann. Epidemiol.* 17, 217–226 (2007).
- Kalichman S, Eaton L, Pinkerton S: Circumcision for HIV prevention: failure to account for behavioral risk compensation. *PLoS Med.* 4(3), e137–e138 (2007).
- Myers A, Myers J: Male circumcision – the new hope? *S. Afr. Med. J.* 97(5), 338–341 (2007).
- Rozenbaum W, Bourdillon F, Dozon J-P *et al.*: Report on male circumcision: an arguable method of reducing the risks of HIV transmission. *Conseil National du SIDA* 1–10 (2007).
- Okeke LI, Asinobi AA, Ikuorowo OS: Epidemiology of complications of male circumcision in Ibadan, Nigeria. *BMC Urol.* 6, 21 (2006).
- Gray RH, Li X, Kigozi G *et al.*: The impact of male circumcision on HIV incidence and cost per infection prevented: a stochastic simulation model from Rakai, Uganda. *AIDS* 21, 845–850 (2007).
- Myer L, Mathews C, Little F: Condom use and sexual behaviours among individuals procuring free male condoms in South Africa. *Sex. Transm. Dis.* 29, 239 (2002).
- de Vincenzi I: A longitudinal study of human immunodeficiency virus transmission by heterosexual partners. *N. Engl. J. Med.* 331, 341–346 (1994).
- Fox M, Thomson M: Short-changed: the law and ethics of male circumcision. *Int. J. Children's Rights* 13, 161–181 (2005).
- Williams BG, Lloyd-Smith JO, Gouws E *et al.*: The potential impact of male circumcision on HIV in Sub-Saharan Africa. *PLoS Med.* 3, e262 (2006).
- Hallett TB, Gregson S, Lewis JJ, Lopman BA, Garnett GP: Behaviour change in generalised HIV epidemics: impact of reducing cross-generational sex and delaying age at sexual debut. *Sex. Transm. Infect.* 83(Suppl. 1), i50–i54 (2007).
- Mor Z, Kent CK, Kohn RP, Klausner JD: Declining rates in male circumcision amidst increasing evidence of its public health benefit. *PLoS ONE* 2(9), e861 (2007).
- Millett G, Ding H, Lauby J *et al.*: Circumcision status and HIV infection among Black and Latino men who have sex with men in 3 US cities. *J. Acquir. Immune Defic. Syndr.* 46(5), 643–650 (2007).
- de Witte L, Nabatov A, Pion M *et al.*: Langerin is a natural barrier to HIV-1 transmission by Langerhans cells. *Nat. Med.* 3, 367 (2007).
- Sorrells ML, Snyder JL, Reiss MD *et al.*: Fine-touch pressure thresholds in the adult penis. *BJU Int.* 99(4), 864–869 (2007).

Websites

- WHO: (28 March 2007) WHO and UNAIDS announce recommendations from expert consultation on male circumcision for HIV prevention. www.who.int/hiv/mediacentre/news68/en/index.html

102. Musoni E, Mutesi F: Rwanda: draw circumcision plans, US tells governments. *New Times*, 29 November (2007). <http://allafrica.com/stories/200711290124.html>
103. Timberg C: Anti-AIDS program to fund circumcision: US initiative targets African men *Washington Post*, 20 August (2007). www.washingtonpost.com/wp-dyn/content/article/2007/08/19/AR2007081900885.html
104. Buyinza J, Kayigwa K: Rwanda: start circumcision with children – UNAIDS *The New Times* (Kigali), 2 December (2007). <http://allafrica.com/stories/200712031074.html>
105. Ministry of Health and Social Welfare, Lesotho, Bureau of Statistics, Lesotho, and ORC Macro International, Lesotho Demographic and Health Survey 2004 Calverton, Maryland, USA (2005). www.measuredhs.com/pubs/pdf/FR171/12Chapter12.pdf
106. Institut National de la Statistique, Ministère des Finances et de la Planification Économique: Rwanda Demographic and Health Survey, Kigali, Rwanda, 234 (2005). www.measuredhs.com/pub/pdf/FR183/15Chapter15.pdf
107. National Statistics Office: Malawi Demographic and Health Survey, Zomba, Malawi, 234 (2004). www.measuredhs.com/pub/pdf/FR175/12Chapter12.pdf
108. Bainemigisha H: Ministry to roll out free circumcision. *The New Vision*, 7 December (2007). www.newvision.co.ug/D/8/13/600931/circumcision
109. Gusongoirye D: Rwanda: nothing can fight HIV/AIDS better than discipline. *The New Times* (Kigali) 12 February (2008). <http://allafrica.com/stories/200802120181.html>
110. Angel CA: Meatal stenosis. *eMedicine* www.emedicine.com/PED/topic2356.htm
111. Ngwa G: Condoms are a key to reducing HIV transmission in Zimbabwe. Geneva: United Nations Population Fund 15 August (2006). www.unfpa.org/news/news.cfm?ID=837
112. WHO: Thailand achieves sustained reduction in HIV infection rates. www.who.int/inf-new/aids1.htm
113. WHO: Senegal contains the spread of HIV. www.who.int/inf-new/aids3.htm
114. Bengali S: AIDS fear drives African men to circumcision procedure cuts risk significantly. *McClatchy Newspapers Kigali, Rwanda*. www.twincities.com/ci_8501296
115. UNAIDS/WHO: Annex 2: HIV and AIDS Estimates and Data 2005 and 2003. Report on the Global AIDS Epidemic (2006). http://data.unaids.org/pub/GlobalReport/2006/2006_GR_ANN2_en.pdf
116. Cairns, G: CROI: AIDS vaccine: additional infection risk restricted to uncircumcised men. *AIDSMAP News* 6 February (2008). www.aidsmap.com/en/news/E30B88ED-2A6C-44D3-9AF6-61DB62FD9D0D.asp

Affiliations

- *Lawrence W Green, DrPH*
Department of Epidemiology & Biostatistics,
University of California at San Francisco,
185 Berry St., Suite 6650,
San Francisco, CA 94143, USA
Tel.: +1 415 514 8115;
Fax: +1 415 839 8109;
lgreen@cc.ucsf.edu
- *Ryan G McAllister, PhD, Biophysics*
Georgetown University,
506 Reiss Science Building,
37th and O St. NW,
Washington, DC 20057, USA
Tel.: +1 202 687 6004;
Fax: +1 202 687 2087;
rgm23@georgetown.edu
- *Kent W Peterson, MD, FACOEM*
Occupational Health Strategies, Inc.,
901 Preston Ave, S-400,
Charlottesville, VA 22903, USA
Tel.: +1 434 977 3478;
Fax: +1 434 977 8570;
kent@healthysell.org
- *John W Travis, MD, MPH*
Wellness Associates,
PO Box 8422,
Asheville, NC 28814, USA
Tel.: +1 206 984 0948;
Fax: +1 206 984 0948;
jwtravis@mindspring.com