Observations on Sansom cost-effectiveness analysis of circumcision against HIV infection in males

Samson et al. analyzed whether circumcision is cost-effective in preventing HIV infection in males in:

EFFECT OF CIRCUMCISION ON U.S. MALES' EXPECTED LIFETIME COST OF HIV
Stephanie Sansom, PhD, Angela Hutchinson, PhD, MPH, Q An, I Hall, A Lasry, and A Taylor.
Centers for Disease Control and Prevention, Atlanta, GA

Their results are summarized in Table 1.

Table 1. Expected lifetime cost of HIV for uncircumcised v. circumcised US males by race/ethnicity, 2003-2004 ($US 2006)

	Uncircumcised	Circumcised	Difference
All males	$2,381	$2,041	-$340 (14.3%)
Black	$8,050	$6,916	-$1,134 (14.1%)
Hispanic	$3,515	$3,175	-$340 (9.7%)
White	$1,168	$1,066	-$102 (8.7%)

Costs used in calculations:

Circumcision cost $678
HIV treatment cost $113,381

It is anomalous for the relative benefit for all males (14.3%) to be higher than the highest relative benefit for any of the ethnic groups. This suggests that the difference for all males ($340) is incorrect. If the differences for each group are correct, the difference for all males, based on the distribution of births by race/ethnicity in 2004, is approximately $310, and the relative benefit is 11.5%.

Although Table 1 makes it appear that circumcision has the greatest relative benefit among Blacks, it is, in fact, among Whites that the greatest proportional reduction in the incidence of HIV due to circumcision would take place to produce the figures in the table. The table implies that circumcision would reduce the number of infections among Whites by 66%, among Hispanics by 29% and among Blacks by 23%.

According to Sansom, "We assumed lifetime HIV risk from heterosexual behavior only reflected a 50% reduced risk among circumcised males." Does that imply that the assumption was made of no reduction in risk from MSM behavior and IDU, which, between them, were responsible for 85% of all infections? That would be a reasonable assumption because, recent studies have shown no protection by circumcision in MSM while, clearly, being circumcised offers no protection from infection by IDU. If the analysis makes the assumption that circumcision reduces risk of heterosexual transmission, which currently accounts for only 15% of all transmissions, by 50%, and has no effect on the risk of transmission by other modes, it is hard to see how circumcision could reduce the number of infections among Whites by 66%.

The benefit for all males according to Table 1 implies that that circumcising all of the approximately 2.12 million boys born annually in the US would result in a reduction in the number of boys in an annual cohort from being infected during their lifetimes of about 19,000. Even using the lower benefit of $310, the implied reduction would be about 18,500.

These figures seem extraordinarily high compared with the current number of annual infections in the US. According to the 2005 HIV/AIDS Surveillance Report published by the CDC, 4,255 males were infected by heterosexual mode in 33 states which it is estimated account for 63% of nationwide infections. Taking into account the different distributions of mode of transmission by race/ethnicity and the different prevalences of circumcision by race/ethnicity, if circumcision reduces a man's risk of infection by 50% then approximately 10,400 males would have been infected nationally if none was circumcised and approximately 5,200 if all were circumcised. In other words, if circumcision reduces a man's risk of infection by 50% then if 100% of the males in the US were circumcised, there would have been about 5,200 fewer infections than if zero were circumcised.

It is difficult to reconcile this relatively low number with the almost four times higher number in Sansom's analysis. Could this mean that Sansom is assuming a much higher prevalence of HIV or risk of infection in the future, which would cause a rise in the incidence (and boost the cost-effectiveness of circumcision if circumcision is assumed to halve the risk)?

In Sansom's analysis, if the reduction in the number of lifetime infections in an annual cohort was less than about 12,500, the net financial value of circumcision to prevent HIV would be negative, i.e., the immediate cost of circumcision would exceed the expected future savings in HIV treatment costs. Again, comparing the required reduction in the number of infections with the current annual number of infections by heterosexual mode, it is difficult to see how circumcision could prevent a large enough number of infections in the future for the net financial value to be positive.

Apart from these arithmetical issues, there are other more serious and less easily remedied problems in Sansom's attempt to establish whether circumcision is justifiable.

The analysis appears to consider only the financial benefits of circumcision in preventing HIV infection against the cost of circumcision.

A true financial analysis must include all costs and benefits, and even that would be inadequate. A comprehensive financial analysis might provide "compelling" evidence that radical female mastectomy at birth or adolesence or after child-bearing is financially advantageous, yet it would not persuade the CDC to assert that the "benefits of prophylactic mastectomy outweigh the risks." It does not follow that something should be done simply because it is financially advantageous. Life is more than financial advantage.

Ignoring other financial costs and benefits renders Sansom's analysis useless because the net present cost of all other
financially calculable costs and benefits might exceed the net benefit in respect of HIV and, even if a comprehensive financial analysis showed a net financial benefit of circumcision, it would not necessarily follow that boys should be circumcised.

Another major weakness, perhaps a fatal flaw, is that the analysis makes predictions about highly uncertain events in the future. Computer projections are too often treated as if they were crystal balls enabling people to see the future clearly and with certainty, when the future they reveal is dependent on assumptions that may be way off the mark. The future course of HIV is wildly uncertain. The average age of infection in the Sansom model is 36, i.e., for boys born in 2008, that would be the year 2044. Does Sansom's model assume that the incidence of HIV infection will be the same in 2044 as now?

That no progress will have been made in preventing or curbing the disease in the next 36 years? It's possible, but it's just one possibility in a range of possibilities that includes the possibility that a vaccine will have been developed well before then. Any analysis that relies on the assumption that HIV incidences will not change in the next 75 years or, more broadly, relies on any assumptions whatsoever about the incidence of HIV in the distant future, is inherently unreliable.

To sum up:

1. There appear to be flaws in the conduct of the analysis.
2. An analysis which does not take into account all costs and benefits of a measure is useless and even if a measure has a net financial benefit it does not necessarily follow that it should be adopted. It is difficult to incorporate all advantages and disadvantages of a measure into a financial analysis because many are not reducible to or expressible in dollar values. Beyond that, moral and ethical considerations can easily outweigh financial considerations.
3. No reliance can be placed on an analysis based on assumptions

about such uncertain values as the future incidence of HIV.

Sansom's analysis is a paltry one upon which to base a recommendation concerning the circumcision of 20 million US-born boys in the next decade.