

The East African AIDS epidemic and the absence of male circumcision: what is the link?



Using circumcision to prevent HIV infection in sub-Saharan Africa: the view of an African

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There are now two schools of thought about the link between lack of circumcision and HIV infection in Africa. One school is that of Bongaarts et al. (1989), Moses et al. (n.d.) and Caldwell and Caldwell (1994) who use geographical distribution evidence to argue that the association between lack of circumcision and a high level of HIV infection in Africa is so convincing that the likelihood of a link should be recognized and taken into account where possible in the battle against AIDS. Moses et al. (n.d.) have gone further to recommend circumcision interventions for Africa. In contrast, De Vincenzi and Mertens (1994) argue that the evidence for an association, at least from small-scale surveys, is doubtful and hence not conclusive enough to qualify circumcision as an intervention.

My view is twofold. First, as scientists we should look at the existing evidence for and against the hypothesis that lack of circumcision is positively related to HIV infection. Although many studies have shown that there is a significant association between the two variables (Bongaarts et al. 1989; Moses et al. 1990; Caldwell and Caldwell 1994), there is no evidence of a causal relationship between the two. Caldwell and Caldwell (1994) pointed out that 'Positive association does not necessarily show a direct causal relationship'.

De Vincenzi and Mertens (1994) make the salient point that most of the quoted studies were not designed to test a hypothesis about circumcision and did not report their methodological details for evaluation. They claim there is no evidence that enough statistical rigour was applied to the data and where, in small-scale studies, this was done by controlling for several variables like age, number of partners, contact with prostitutes, ethnic origin and birthplace, the results lost statistical significance (Greenblatt et al. 1988). Either those findings that did not fit into the conventional thinking of the hypothesis were rejected by the journals as not interesting, or the researchers did not submit them for publication for fear of rejection.

As in the study by Serwadda et al. (1992), recent work on data from the 1987/88 National Survey of Uganda assumed Muslims to be circumcised and non-Muslim Ugandans not to be circumcised. This was a fair assumption since the cultural groups that circumcise were not included in the National Survey. The study shows an association at the bivariate analysis which disappears at the multivariate level (Tusingwire 1995). Perhaps the fact that the Muslims are more polygynous than other groups eliminates their circumcision advantage.

Another set of Ugandan data that can be used is one based on our recent study of the impact of AIDS on families in six districts of Uganda. One of the six districts, Mbale, is dominated by the Bagisu, the largest of the few cultural groups in Uganda that circumcise boys before they are accepted as men in the society. Other circumcision groups are the

Bakonjo, Sebei and Bamba in order of population size. Preliminary analysis of the logistic regression on the Bagisu data indicates that the Bagisu are less likely to be AIDS victims than the other six ethnic groups. Other cultural groups with similar results to those of the Bagisu are the Bakiga of the extreme southwest and the Banyoro of western Uganda. In contrast, the Baganda, Banyankore, Banyarwada and Basoga were more likely to be AIDS victims than the other groups combined. It is difficult to attribute these findings to circumcision levels in the cultural groups because the Bakiga and Banyoro in the former category do not have many circumcised people while a large proportion of the Basoga in the latter group are Muslims and circumcised. A more plausible explanation of the pattern is that the Bagisu, Bakiga and Banyoro are farther from the epicentre of the Ugandan epidemic than the other four ethnic groups. At this stage, it is therefore difficult for researchers to use the available evidence and comfortably recommend circumcision as a policy in combating HIV infection.

On the other hand my second view is based on practical public policy arguments. As an African who has seen Africans perish from AIDS, it is my opinion that any measure which has a chance to succeed in curing AIDS, reducing the suffering of the people from the disease and preventing the infection of HIV should be tried. I believe that it was in this spirit that several drugs including Kemron and AZT were tried on many African patients, despite their known serious side effects. Hence, there is an urgent need to carry out controlled experiments in Africa on the hypothesis of circumcision.

However, I do not agree with Caldwell and Caldwell (1994) when they claim that sexual behaviour is not changing fast, and the use of condoms is not adequate. It is unrealistic to expect the highly traditional societies of sub-Saharan Africa to change their cultures by abandoning their dangerous sexual customs and practices and accepting the alien condom faster than has so far been demonstrated. Brunborg, Fylkesness and Msiska (1993) have found that in less than a decade since the advent of AIDS, Zambian societies have either stopped or modified their centuries-old funeral rite of a brother of the deceased having sexual relations with all the widows.

Secondly, while in 1988/89 the Uganda Demographic Survey reported less than one per cent of national condom use (Kaijuka et al. 1989), Konde-Lule (1992) found that 15 per cent of adolescents in Rakai district used the method, a multiplication by fifteen in a couple of years.

More recently, our national study of focus group discussions in six districts (Ntozi and Mukiza-Gapere 1992) found that elders and youths reported that the previous customary practices for marriage and death that are now considered dangerous because of AIDS are being abandoned or modified to suit the circumstances. It was found that, in contrast to the past situation where wives were shared by brothers among the Banyankore of southwest Uganda (Ntozi et al. 1991, study done in 1984), this custom has disappeared fast over less than a decade. Widow inheritance, previously common to most societies in Uganda, is now a thing of the past for fear of AIDS. The excesses in sexual activities practised by the Baganda of central Uganda during funeral rites and by the Bagisu of east Uganda during circumcision ceremonies, have been considerably reduced. I think the Africans deserve more credit for these fast socio-cultural changes than Caldwell and Caldwell (1994) have given them.

It is important that, while circumcision interventions are being planned, several points must be considered carefully. If the experiment fails, Africans are likely to feel abused and exploited by scientists who recommended the circumcision policy. In a region highly sensitive to previous colonial exploitation and suspicious of the biological warfare origin of the virus, failure of circumcision is likely to be a big issue. Those recommending it should know how to handle the political implications.

A second public concern will be the expenditure involved in conducting circumcision. If it is on a large scale, some international donors may divert funds earmarked for other social services to this exercise. It will also be the fear of the African governments that in the middle

of this exercise some donors may withdraw their funds for political reasons or not be able to pay for the whole exercise including effective follow-up of the circumcision campaigns to ensure no side-effects are left unattended. The reluctance of external donors to pay fully for family planning activities and hence leaving many acceptors with side-effects untreated is fresh in African memories. Governments would therefore not like to start an exercise involving people's suffering that would not succeed with clear benefits to the public.

Thirdly, in some societies of Uganda such as the Bakiga and Banyankore, a circumcised person (*owempari*) is culturally stigmatized. For instance, circumcised people or those with the foreskin not completely covering the penis are believed to be hot-tempered and unsocial. Sayings such as *Kunotabuka nk'owempari* ('You are as hot tempered as one circumcised') are common in these ethnic groups. It is considered a bad omen for parents to have a child with a penis half covered by the foreskin. This is perhaps why only a tiny proportion of the Banyankore and Bakiga, less than one per cent, is Muslim (Republic of Uganda 1992). Caldwell and Caldwell (1994) suspect that it was difficult for Islam to be accepted by most ethnic groups that did not circumcise because it was considered unnatural to circumcise. This cultural resentment, added to the health issues described by De Vincenzi and Mertens (1994), may make some African governments reluctant to agree to participate in or allow the adoption of a policy of circumcision. It will, therefore, be important for governments in the region to spend a lot of money on educational campaigns before they take the political risk of mass circumcision. Since most African countries have strained economies, it will be difficult to find the necessary funds.

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Male circumcision and the AIDS epidemic in Africa*

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Two papers were published in 1994 reviewing the literature on the association between male circumcision and risk for HIV infection. The results of these reviews are summarized and discussed. In an attempt to assess the potential impact of circumcision as an intervention to reduce HIV transmission, a model is developed in which HIV is simultaneously introduced into two populations, one in which male circumcision is universally practised, and one in which it is not. Ten years after introduction, the HIV prevalence in the population in which male circumcision is practised is shown to be over ten times lower. It is concluded that male circumcision could be an effective intervention for reducing HIV transmission.

Evidence implicating lack of male circumcision as a potential risk factor for HIV acquisition was first reported from observational studies conducted in Kenya in the late 1980s (Greenblatt et al. 1988; Simonsen et al. 1988; Cameron et al. 1989). Since then, numerous clinical and ecological studies have examined the association between male circumcision and risk for HIV acquisition. Recently, two analytical reviews of the relevant literature were performed (Moses et al. 1994; De Vincenzi and Mertens 1994).

Moses et al. identified 30 epidemiological studies (26 cross-sectional, two prospective and two ecological) which have investigated the association. Fifteen were published as papers and 15 as conference abstracts. Of the 26 cross-sectional studies, 18 from six countries (five African countries and the USA) found a statistically significant association on univariate or multivariate analysis between the presence of the foreskin and risk for HIV infection. In four others, trends towards an association were found. In four studies (from Rwanda and Tanzania) no association was demonstrated. The two prospective studies (both from Kenya) and the two ecological studies from Africa both found positive associations.

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In those studies in which statistically significant associations between lack of male circumcision and risk for HIV infection was demonstrated, odds ratios or relative risks ranged from 1.5 to 8.4. Of 14 studies in which multivariate analysis was conducted, eleven found a statistically significant association between the presence of the foreskin and susceptibility to HIV infection. Of these eleven, there were nine in which data from univariate analysis were also reported. In eight of these, the adjusted multivariate odds ratios or relative risks were equal to or higher than the univariate ones.

The authors of the review discussed potential sources of error, including possible confounding factors such as sexual behaviour, religion, urban-rural location, misclassification and the presence of other sexually transmitted diseases. However, in examining Hill's (1965) criteria for making causal inferences from epidemiological studies, most appeared to be met. Explanations were offered for why some studies may not have observed an association. After examining further research needs, including intervention studies, the conclusion drawn was that male circumcision should be given serious consideration as a potentially effective intervention to reduce HIV transmission.

De Vincenzi and Mertens in their review adopted a more cautious approach, concluding that stronger evidence from observational studies is required before public health interventions or even intervention studies should be undertaken. They reviewed 23 published reports linking circumcision status to HIV infection, and classified them into four groups: six retrospective partner studies, twelve other retrospective studies, two cross-sectional sero-surveys, one longitudinal study and two ecological studies. They reported positive associations from three of the partner studies, six of the other retrospective studies, one of the sero-surveys, the longitudinal study and the ecological studies. The main reason for the discrepancies between the two review papers is that, although there was considerable overlap in the studies identified in them, there were also many discordancies, due presumably to differences in the search methodologies and the time periods for the studies reviewed (the paper by Moses et al. was published later).

De Vincenzi and Mertens discussed several potential confounding factors, the most important of which is sexual behaviour. It is possible, for example, that uncircumcised men engage in 'riskier' sexual behaviour than circumcised men. But, as Caldwell has noted, the main AIDS-non-circumcision belt in east-central Africa (Moses et al. 1990) cuts across patrilineal and matrilineal societies and across Gluckman's father-right societies and their opposite, and it would be difficult to argue that they could all be identified with an atypical kind of sexuality (Caldwell, Caldwell and Orubuloye 1992). Other potential confounders identified by De Vincenzi and Mertens were the presence of other sexually transmitted diseases (particularly genital ulcer disease) and hygienic practices. However, as Moses et al. (1994) have noted, if genital ulcer disease is a risk factor for HIV acquisition, and if lack of circumcision is a risk factor for genital ulcer acquisition (for which there is considerable evidence), then lack of circumcision is also a risk factor for HIV acquisition, independent of any direct effect. Whether the mechanism of increased risk is primarily direct or indirect is important only in that, if the latter were the case, then an intervention to increase the practice of male circumcision would affect HIV transmission primarily in areas where those STDs were prevalent. Similar reasoning would apply to poor genital hygiene.

In determining how vigorously to pursue the circumcision issue, either in terms of conducting more observational studies, undertaking an intervention trial or adopting circumcision as an HIV control strategy, it is useful to consider what the population attributable risk for HIV infection of a factor such as lack of circumcision might be. If the relative risk of lack of circumcision were two, which is at the low end of estimates obtained from many studies, and if circumcision were not practised by 20 per cent of the male population, which is roughly the case in Kenya, then the population-attributable risk for HIV infection would be about 17 per cent. If circumcision were not practised by 80 per cent of the

population, which is in the lower range for countries such as Uganda, Zambia, Malawi and Zimbabwe, then the population attributable risk for HIV infection would be about 44 per cent. A relative risk of three would make the population attributable risks approximately 29 per cent and 61 per cent respectively. These attributable risks are considerable, but may in fact underestimate the potential contribution of lack of circumcision to the AIDS epidemic because of the exponential growth of HIV infection in populations, at least during the early stages of an epidemic. Thus, even a small increase in transmission efficiency conferred by a factor which is highly prevalent in a population, such as male non-circumcision may be, can result in a large increase in population seroprevalence over a period of years.

Figure 1
Development of HIV epidemics in model African populations where male circumcision is and is not practised

Figure 1 shows the results of a modelling exercise which was undertaken to explore the potential impact of male circumcision in leading to a reduced prevalence of HIV infection in a population over time. We used May and Anderson's (1987) model of HIV transmission, and hypothetically introduced the virus simultaneously into two distinct populations, one in which male circumcision was universally practised, and one in which it was not. We assumed that at time 0, the prevalence of infection in both populations was 0.1 per cent. We also assumed a fixed duration of five years of infectivity, based on recent data from Kenya (Anzala et al. 1995). In the population in which male circumcision was not practised, a doubling time of infection of two years was assumed, which is typical for many African countries in the early stages of an HIV epidemic. In the population where male circumcision was practised, it was assumed that the efficiency of female-to-male transmission was three times less,

corresponding to a relative risk of one-third. This resulted in a doubling time of infection in that population of approximately 3.5 years. We ignored saturation effects, which would reduce the prevalences somewhat, as well as demographic effects: that is, we assumed that people dying of HIV infection were replaced by uninfected individuals. After ten years, the prevalence of HIV infection was 0.74 per cent in the model population in which male circumcision was practised, compared to a prevalence of 14.8 per cent in the population in which circumcision was not practised. This projected difference in HIV prevalence approximately a decade after introduction of the virus is roughly comparable to the difference observed between Nigeria, where circumcision is almost universally practised, and countries such as Zambia or Malawi, where circumcision is rarely practised.

Although this model is based on simple assumptions, it appears that the reduction in transmission efficiency achieved by eliminating this risk factor could over time lead to significantly reduced HIV transmission. The effect of eliminating the risk factor on the equilibrium HIV prevalence is more difficult to predict, as this prevalence depends on more factors than the basic reproductive rate of infection. It is likely, though, that the effect of circumcision, as with most interventions to control HIV transmission, would be to slow the course of the epidemic until more definitive solutions could be effected. With few effective medical interventions on the horizon, and with significant behavioural change an elusive and probably long-term proposition, other interventions which might slow the course of the AIDS epidemic are urgently needed.

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Sexually transmitted diseases, genital hygiene and male circumcision may be associated: a working hypothesis for HIV prevention*

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The concept of confounding is tricky. To illustrate it Leon (1993) recently imagined an epidemiological study which found that people who carry matches have an increased risk of lung cancer. Apart from its value as an academic concept, it is not very useful for public health decisions. In this paper we shall not concentrate on the reasons why there is a 'lurid' epidemic in Africa (Caldwell and Caldwell 1995: 19), but rather on the question of whether an observed association between HIV serological status and male circumcision can effectively be translated into a research and action agenda. Full understanding of the dynamics of the HIV epidemics in different regions of the world is only likely in the medium-to-long term as the research agenda encompasses a broad spectrum of issues. These issues include the need for a better understanding of sexual mixing patterns, the potential role of the demographic structure of the population as a potential modifier of the contraction or expansion of regional epidemics, shifts of transmission to younger age groups, the contribution of HIV genetic variability to infectiveness and transmission, the variability of infectiveness at different times after HIV infection, as well as the role of potential risk factors for transmission, such as other sexually transmitted disease or circumcision status (Mertens et al. 1994).

Regarding the role of male circumcision in relation to HIV infection, we are pleased to share with Caldwell and Caldwell the same concerns, namely 'a better understanding of the disease' (Caldwell and Caldwell 1995: 14) and the search for 'a genuine mechanism [through which lack of male circumcision could facilitate HIV transmission, and which] offers the possibility of effective intervention' (Caldwell and Caldwell 1995: 16).

Correlations put into perspective

For the last few decades, epidemiological research has been concerned with scrutinizing and tracking levels of physiological, environmental or behavioural characteristics, which are perceived to be potential perils to communities and individuals. In this endeavour, researchers whose studies show 'no effect' either do not submit their results, or find it difficult to get them accepted for publication (Koren and Klein 1991). In spite of this, enthusiasm prevails with, as testimony, the sheer number of monthly publications discovering new associations between risk factors and disease, for consumption by the medical community and the general public, with the hope that rapid modification of these factors will lead to a better life. With increasing quantity some of the quality has gone, and it has become standard practice to neglect the methods section as a black box and scan swiftly the study results and conclusions. This is unfortunate since the validity of the study conclusions crucially depends on the

* This article and its views are those of the authors solely.

methods of measurement (Mertens 1993). Once an association between a factor and a disease process is observed, the question of public health interest is: what can be done about it? In the case of the matchbox, if the association is causal, then its removal will have an effect on disease occurrence.

Similarly the observation of an association between HIV infection and lack of male circumcision may represent a causal effect or may be due, wholly or partly, to the influence of confounding or intermediate variables. On an epidemiological basis, it is first possible that circumcised men have different sexual behaviours, or different penile hygiene, from uncircumcised men, which in turn may influence their susceptibility to HIV infection. Secondly, it is possible that circumcised men differ from uncircumcised men in their reporting patterns to health facilities for genital problems. Thirdly, as mentioned by Caldwell and Caldwell, it is also possible that the same level of washing or other hygienic measures would ensure a lower level of genital cleanliness among uncircumcised men because of the penile foreskin (Caldwell and Caldwell 1995: 16); that is, genital cleanliness lies on the causal pathway between circumcision status and HIV or other sexually transmitted diseases (STD). Finally, uncircumcised men may be at increased risk of HIV because they may be more susceptible to other STD than circumcised men (e.g. Nsanze et al. 1981); other STD being potential risk factors for HIV transmission. It must be noted that these possibilities are not mutually exclusive, but each of them has different implications for public health intervention. On a strictly biological basis, two recently published papers reviewed extensively the potential mechanisms through which lack of male circumcision could increase susceptibility or infectivity for both STD (Cook, Koutsky and Holmes 1994) and STD/HIV (De Vincenzi and Mertens 1994). Both papers concluded that, although there were several plausible mechanisms, more research was needed to determine which were operating in different cases.

Have the possibilities for HIV prevention been fully explored in relation to the association with male circumcision?

To illustrate the possibility that the association between circumcision and HIV might be confounded by penile hygiene, but not that genital cleanliness lies on the causal pathway to HIV infection, a situation was considered in a recent paper where one man in ten has irregular, or usually poor, penile hygiene. The magnitude of this association is half of that observed when failing to subdivide the data on the basis of genital hygiene behaviour. A study failing to take account of penile hygiene and other potential confounders is likely to overestimate the magnitude of the true association between lack of circumcision and HIV infection (Mertens 1993).

To adjust successfully for confounders the instruments to measure them should be perfect. In practice, both sexual and hygiene behaviour are likely to be variable over time and between different individuals, making an accurate assessment of their 'usual levels' extremely difficult. In addition, it is likely that the quality of the assessment of those recording the levels of confounders will also vary (within- and between-observer bias). Finally it is easy to imagine that the respondents themselves may provide inaccurate answers about their personal practices. Using the same example, if 50 per cent of men with 'non-regular' penile hygiene were classified as having 'regular' penile hygiene, and five per cent of those with 'regular' hygiene were misclassified as having 'poor' penile hygiene, the results would lead to a serious overestimate of the true association between lack of circumcision and HIV infection even though we may believe that we have 'controlled' for a confounding variable (Mertens 1993). The results of such a study may mislead both researchers and policy makers with the certainty that circumcision status is 'independently' associated with HIV

status: hence the proposal that male newborn or adult circumcision might be undertaken on a wide scale for the control of HIV (Fink 1987; Marx 1989).

However, introducing male circumcision as a public health intervention — in contrast to maintaining the practice where it already exists — has major implications, and therefore, should not be embarked upon lightly.

Male circumcision is not without medical side-effects; with regard to newborn circumcision, septic complications may occur in poor hygienic settings, although to our knowledge no systematic data have been collected. Complications are likely to be even more problematic in adolescent and adult circumcision, possibly causing pain, haemorrhage, and problems of healing. Thus, adult and, in some settings, newborn circumcision may generate more harm than benefit. The onus is therefore to produce adequate evidence of safety before a supposedly protective intervention is implemented (Rose 1985).

Besides potential benefits to be obtained and the safety of a public health intervention, it is important not only to examine its acceptability and feasibility, but also to compare these characteristics with those of alternative interventions. The acceptability of a new practice on the male reproductive tract is likely to be problematic in settings where the religious and socio-cultural context usually outweighs public health considerations. Behavioural changes, at least as important as those required for the adoption of condoms, and a general shift in social norms will clearly be required to introduce male circumcision as a new general practice. Furthermore, operational requirements needed to introduce neonatal, adolescent or adult circumcision are likely to be considerable. In many cases, such an undertaking will require mass communication programs for public education, training of overburdened health-care personnel, and supplies necessary for the surgical procedure. If it is assumed that there is an association between circumcision and sexually acquired diseases, and given limited public health resources, the ratio of benefits and costs and the range of culturally acceptable alternative interventions such as condom promotion for the control of HIV and STD have to be considered in each setting (De Vincenzi and Mertens 1994).

In this respect, the outcome of another public health debate, that of the interaction between HIV and other sexually transmitted diseases, is illustrative. There, the potential benefit of initiating widespread control of STD through the primary health care system was beneficial in its own right, without any associated harm, and regardless of whether it would also prevent HIV transmission. The recommendation was, therefore, to launch expanded STD control programs as early as possible with the additional objective to examine their impact on HIV spread (Mertens, Hayes and Smith 1990).

The possibilities that penile hygiene or that genital cleanliness, with a given level of hygiene, may play a role in facilitating transmission of STD/HIV among uncircumcised men have not been examined carefully to date. To our knowledge no systematic data have been collected on the latter in order to establish possible differences between circumcised and uncircumcised men. We know of only one study which gathered some evidence that there were differences between circumcised and uncircumcised men in genital cleanliness and the presence of inguinal adenopathy (Seed et al. 1995). A proposal for soap and water prophylaxis to limit genital ulcer disease and HIV infection has also been put forward (O'Farrell 1993). In spite of the difficulties associated with such studies, if it proved feasible to implement effective behavioural changes related to genital hygiene, this might be an important addition to the limited range of interventions that can at present be deployed against HIV: hence the focus prompted in that direction by De Vincenzi and Mertens: 'Studies of the association between circumcision status and sexual and [genital] hygienic behaviours in different populations, using both quantitative and qualitative methods, should highlight the strength of potential confounding effects' (De Vincenzi and Mertens 1994: 158). It is unfortunate that Caldwell and Caldwell misinterpreted the proposal as a 'desperate suggestion' namely, that the level of general hygiene as indicated by 'the weighted life

expectancy and other mortality measures' (Caldwell and Caldwell 1995: 16) needed further study. Some level of bad faith must have been required for such misinterpretation since in the introduction De Vincenzi and Mertens already set the problem quite clearly:

if circumcision reduces the transmission of genital infections, either by improving local hygiene or by accelerating the healing of otherwise subpreputial lesions, circumcision may also delay HIV transmission. Therefore, potential associations between the lack of circumcision and STD, other than HIV, are also of interest (De Vincenzi and Mertens 1994: 153).

Furthermore, De Vincenzi and Mertens also developed the hypothesis that among the sexually acquired diseases which need further study of their potential association with circumcision, priority should be given to genital ulcer disease (GUD), of which chancroid is one of the main causes, for several reasons. First, previous studies provide more arguments for an association between the lack of circumcision and GUD than between the lack of circumcision and urethritis. Secondly, a potential association between the lack of circumcision and duration of genital symptoms might be stronger for GUD than for urethritis. Thirdly, one of the mechanisms through which a potential association between the lack of circumcision and HIV infection could operate is the suspected association between GUD and HIV infection. The assessment of an indirect effect requires the assessment of the two underlying direct effects (lack of circumcision → GUD, and GUD → HIV). Simultaneously obtaining both assessments within the same study would most likely be difficult. For example, in a recent study, the relationship between circumcision, history of GUD and non-ulcerative STD, and HIV was complex (Seed et al. 1995). Eleven per cent of circumcisions had been performed for treatment of sequelae of STD and these participants were excluded from the analyses. Uncircumcised men were also having less risky behaviours than circumcised men but were more likely to have had a history of genital ulcer (Seed et al. 1995). Fourthly, GUDs are more common than HIV infection in some parts of the world: recruitment of cases may therefore be easier. Finally, the date and the source of infection are easier to determine for GUDs than for HIV infection (De Vincenzi and Mertens 1994). We therefore agree with the statement that 'it may be almost as important to discover the determinants of chancroid as of HIV infection' (Caldwell and Caldwell 1995: 13).

Conclusion

Programs targeting diagnosis and treatment of GUD as an HIV/AIDS prevention strategy are now being implemented. An important question for the development of future prevention strategies is whether lack of male circumcision confers risk of HIV that is independent of the risk attributable to sexual behaviour, genital hygiene or cleanliness, and that attributable to GUD. The available evidence shows that circumcision status is strongly related with all these factors and that these relationships are important to examine when examining the relationship between circumcision status and HIV (Seed et al. 1995). Unfortunately, ecological correlations, while important to generate hypotheses, are unable to examine these relationships in any detail. Therefore, a variety of other methods need to be used and have been proposed elsewhere (e.g. De Vincenzi and Mertens, 1994).

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Regional HIV prevalence and ritual circumcision in Africa*

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The hypothesis that the cultural practice of male circumcision in Africa correlates regionally with human immunodeficiency virus (HIV) prevalence rates needs refining and further testing. Several 'confounding factors' (De Vincenzi and Mertens 1994) such as changing patterns of sexual behaviour, experiences of famine, migration, wars, and wage labouring may well have changed cultural circumcision practices and hence confused a spatial correlation with prevalence rates and the AIDS epidemic. A way is suggested here for creating a contemporary relevance index for evaluating ethnographic data on male circumcision and other cultural practices. This is important because despite the uncertainties involved, some authors are now suggesting male circumcision 'as an effective intervention to reduce HIV transmission' (Moses et al. 1994: 209). The employment of a contemporary relevance index should help sharpen tests of the hypothesis that HIV+ is lower among societies or cultures which 'traditionally', that is, ritually, circumcise males than it is among populations which do not. Some greater assurance is needed than has been offered thus far of

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the value of regional correlations of ethnographic data and HIV prevalence rates for purposes of arriving at possible strategies for intervention, or for 'historical' reconstruction of HIV origins.

The prophylactic value of male circumcision in Africa is based in large part on surveys at clinics where sexually transmitted diseases (STDs) are treated (Hira et al. 1990; US Bureau of Census 1994; Moses et al. 1994). Fewer circumcised than uncircumcised patients are found with genital ulcers and/or cancer. This is a repeated clinical finding of at least 30 years' standing (Dodge and Kaviti 1965). More recent correlations have been found between chancroid and testing positive for HIV (see Plummer et al. 1983; Piot et al. 1988; Simonsen et al. 1988). Many of these STD clinics are in urban surroundings or are associated with sentinel health centres in provincial settings. Data from these clinics and centres are used in estimating HIV prevalence rates over wider areas.

Several attempts have been made to relate area prevalence rates to mapped distributions of cultural circumcision practices. I took part in one of the first such attempts (Bongaarts et al. 1989) which found statistically significant correlations between HIV prevalence rates for regions in which circumcision is a 'cultural' practice and those in which it is not. A second 'ecological' study found positive correlations between 'discrete HIV seroprevalence points' and 'variations in circumcision status' (Moses et al. 1990: 696). And most recently Caldwell and Caldwell (1995: 12) identify 'a large, contiguous population where no males are circumcised, found wholly within the major AIDS belt' and, in addition, these authors speculate on a possible origin area for the virus.

All three of these studies, including the one to which I contributed, could benefit by a more critical approach to the ethnographic data, including a closer look at accounts of circumcision rituals, and at the mapping procedures by which ethnographic information is displayed and correlations sought with HIV prevalence levels.

A more critical approach

We need a 'contemporary relevance index' for ethnographic and other source materials to reflect something of the way the data were originally gathered as well as their present value in the light of the sometimes tumultuous changes taking place in Africa during the past 100 or more years. I have in mind in particular information abstracted from the Human Relations Area Files, Murdock's (1967) 'ethnographic atlas', his reconstruction of African history (1959) and the earlier (1958) summaries of African cultures on 5x8 file cards. These and other sources such as the International African Institute's long-running series of volumes in the *Ethnographic Survey of Africa* are important resources. But no matter how current they may have been at one time, if the people being described have been bombarded with imperialist wars, the imposition of colonial policies, tourism, economic development, political upheaval, local conflicts, famines, epidemics, to say nothing of the creation of infrastructural facilities such as roads, railways, markets, expanding systems of health care, education, and communication, then surely older source materials must be evaluated in terms of their present relevance to contemporary problems such as the AIDS epidemic. In analytic cartography the handling of possible 'source errors' (Clarke 1990) is an important topic and has been for some years; see, for example, Porter (1957) on the relative reliability of demographic data, and Conklin (1980) on mapping ethnographic information.

In my own thinking (Conant 1988) I have suggested using such factors as the scale of the original research, the kind of methodology used in fieldwork and later analysis, and the amount of time and number and kind of events which have taken place since the original observations were made in order to arrive at the equivalent of a contemporary relevance index. To fail to take such possibly 'confounding' factors into account amounts to assuming that the African countryside and its peoples are in some way immune to change and that

cultural practices such as circumcision (or no circumcision) and degrees of sexual permissiveness are fixed for all time. Such a view of rural populations is not too different from assuming that the populations of the African countryside beat to a kind of heart of darkness:

So fundamental are the beliefs in circumcision or its lack that nearly all ethnic groups are either fully circumcised or uncircumcised, and, with the special exception of the Akan of Ghana, the evidence seems to be that there has been no fundamental change since the 1950s (Caldwell and Caldwell 1995: 15).

What is the authority for such an assertion? Or for imagining 'an original epicentre in Rwanda, southwest Uganda or northeast Zaire' (Caldwell and Caldwell 1995: 10) as though these populations were out of touch with the rest of Africa:

It is just conceivable that, somewhere unnoticed by the colonial medical regimes, perhaps in an isolated part of Middle Africa, the disease could have smouldered (Caldwell and Caldwell 1995: 19).

Vansina (1990) directly disputes the notion that Equatorial Africa was a cultural island, isolated from surrounding areas and their populations. Archaeological, linguistic, ethnographic and historical data are adduced to show the interpenetration of the cultures inside and outside the central African rain forests. Note in particular Vansina's own mappings, including No.1.3 which reflects the quality of the original data. In another approach, Kopytoff (1987) has edited a series of essays on the establishment, maintenance and permeability of African cultural and political frontiers in West, Central and East Africa. In the context of the search for the putative African origin of HIV perhaps the notion of an incubating 'island' (Caldwell and Caldwell 1995: 19) needs to be re-examined in the light of the work of Vansina and Kopytoff.

Examine the ritual itself

A second suggestion for refining the circumcision hypothesis is to take a hard look at the variability inherent in the operation itself. I was a participant as sponsor of initiates in Northern Nigeria in 1957 and witnessed male and female circumcision rituals in Northwest Kenya in 1962 and 1978: my retrospective impressions are of variability in the degree of foreskin removal; in the age range of initiates, from about 10 to 30 years; and in the degrees of sexual experience of the initiates; of the uncertain intervals between circumcision rituals; and of the often large difference between verbal accounts offered by key informants (the 'ideal' ritual), and behaviour as witnessed by the ethnographer or other observer (the 'real').

While my fieldnotes record some of the above, their significance did not become evident in a major way until this, the age of AIDS and the debate over the potential prophylactic value of male circumcision as an intervention strategy. A report is being prepared on these direct observations of circumcision rituals, and perhaps it will elicit from others further comment on the variability in the performance of ritual circumcision. If even before independence in the 1960s circumcision rituals were being adapted to new circumstances, how much more variability might be associated with all the events that have happened since in African countries? How 'constant' can rituals have remained that were recorded by direct or indirect means many, many years ago, and subsequently encoded in the Human Relations Area Files and Murdock's (1967) ethnographic 'atlas'? Simply because circumcision is reported in the literature, and thereafter summarized as present or absent, it should not be assumed of males that they lack sexual experience before the ritual or that the operation

involves total removal of the foreskin and therefore uniformly offers a measure of protection from STDs and HIV.

More meaningful maps

The foregoing leads to the third step needed to refine the circumcision and other, regionally based hypotheses relating to AIDS and HIV prevalence levels. We surely and urgently need to improve the mapping process by taking advantage of the analytic procedures developed in geographic information systems and which are now readily available (e.g. Eastman and McKendry 1991; Eastman 1993; Monmonier 1991, 1993; Jones 1993, 1994). Methods of spatial analysis have been around for some time but their application, with rare exceptions (Conklin 1980) seems to have been neglected in the social sciences. Murdock's ethnographic map of Africa (1959, end map) presents the entire continent as though exclusively and totally occupied by hundreds of cultural groups (with the exception of two 'uninhabited' areas of the Western and Central Sahara, where, in fact, there are important oasis populations). While this is partly a function of scale the presentation is misleading in that the viewer is given no sense of the way in which different African cultures often share the same resources within the same ecozone or zones. A prime example in East Africa would be the Pokot who circumcise and the Turkana who do not, and the way in which two subsistence systems, farming and free-range herding, so often treated as antithetical to each other in the ethnographic literature, are in fact integrated within the same social unit (Conant 1965).

This kind of interpenetration complicates the geography of circumcision and the certainty of inferences to be drawn from oversimplified spatial distributions. Trait distributions do not always exhaust geographic space, a lesson learned many years ago in the attempts to map first *kulturkreis* and later the culture areas of Africa.

At the very least published maps should include estimates of spatial error and some summary statistic of the contemporary relevance of the ethnographic materials on which the map is based, the contemporary relevance index mentioned at the outset of this comment. To do less is to run the risk of perpetuating myths about Africans, much as the non-existent Kong Mountains were perpetuated in maps of West Africa (Bassett and Porter 1991).

Finally I should like to make a plea for a less strident tone in the arguments about HIV prevalence rates and circumcision. It seems not to be an open-and-shut case, pro or con, and there are many competing and promising leads to be investigated; see, for example, Gould (1993) on prevalence rates and the location of airports, and Shannon, Pyle and Bashshur (1991) on migration. If there is uncertainty about the prophylactic value of circumcision in a 'developed nation' (Donovan, Basset and Bodsworth 1994) why should there not be some uncertainty in all the many nations and urban areas of Africa? And might not some of this uncertainty arise from the response of Africans, reflected in their circumcision rituals, to a full 100 years of outside influences, interference, and exploitation, and, previous millennia of internally generated political expansions, trade, conquests, migrations and retreats? Is it even thinkable that rituals, attitudes, and behaviours would not or could not change? A recent report (Green, Zokwe and Dupree 1993) quotes a 'traditional healer' on the topic of cultural resistance to circumcision in non-circumcising societies: 'When tradition and the health of our people are in conflict, it is tradition we must sacrifice'. If this is true in today's times, why not ritual change throughout Africa's yesterdays?

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Lack of male circumcision and AIDS in sub-Saharan Africa: resolving the conflict

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I have been author or co-author of three papers arguing the likelihood that lack of male circumcision is a risk factor for HIV transmission and that the location of the main AIDS belt in East and Southern Africa (Uganda, Rwanda, Burundi, a limited part of eastern Zaire, western Kenya, western Tanzania, Zambia, Malawi, Zimbabwe and Botswana) was determined by the fact that the peoples living in that belt did not practise male circumcision. The first paper (Caldwell and Caldwell 1993a) examined a range of hypotheses which we had researched and had rejected as disproved, and then drew on Bongaarts et al. (1989) and Moses et al. (1990) to argue that lack of male circumcision neatly explained the strange geographical distribution of the populations with the highest incidence of the disease and that the epidemiological evidence was probably irrefutable. The second paper (Caldwell and Caldwell 1993b) examined and attempted to evaluate the methodology and data employed by Bongaarts et al. (1989) and Moses et al. (1990) to decide if they were sufficiently flawed to weaken fatally their hypothesis. The third paper (Caldwell 1994) devoted attention to the distribution of the disease among the general population rather than the high-risk population, using the latest data at that time (US Bureau of the Census 1993). It also criticized an Editorial Review in the journal *AIDS* (De Vincenzi and Mertens 1994) for what I considered an almost cavalier disregard for the importance of the epidemiological evidence and a perhaps careless failure to state that case properly¹.

The argument of these three papers can be summarized as follows.

¹ To stimulate discussion among the contributors to this Forum and to identify some of the issues, the invitations were accompanied by mimeographed versions of the second and third papers. At that time, the second paper (Caldwell and Caldwell 1993b) was available only in the form in which it had been presented at an IUSSP workshop in Annecy, France in December, 1993, but it is now available as Caldwell and Caldwell 1994. The third paper (Caldwell 1994) was available only in the form of an address to the September 1994 Annual Conference of the British Population Society in Durham, England. There were no plans for publication, but, as Mertens and Cara'l refer to it in this Forum, in order that their paper can be fully followed, it is reproduced as Caldwell and Caldwell 1995.

(1) The geographical correlation between the areas where males are not circumcised and those with the highest incidence of HIV/AIDS is so high that it cannot be explained as accidental, but must demonstrate either direct or indirect causation or both, with the proviso that the methodologies and data of Bongaarts et al. (1989) and Moses et al. (1990) were adequate. These two papers met all of Bradford Hill's (1965) criteria for the demonstration of causation. Caldwell and Caldwell (1993a) forecast, at a time when there was little surveillance evidence for the proposition, that Botswana was at risk of a major epidemic, a prediction that has subsequently proved correct. There was small-scale clinic and survey evidence from Kenya and Uganda which supported the hypothesis (Cameron et al. 1989; Berkley et al. 1989; Plummer et al. 1991; Moses et al. in this Forum), although admittedly there was other survey evidence (which we assessed as having insufficiently presented data) which did not support the hypothesis.

(2) We assessed the methodology and data employed by Bongaarts et al. and Moses et al. as adequate. Their methodologies differed but sufficed for the purpose. The HIV surveillance estimates vary greatly in quality and adequacy of documentation but the overall pattern is sufficiently free of major discrepancies in measures carried out over a short time or small geographical distances to be usable. The data on male circumcision status is on an ethnic-group basis and is drawn largely from Murdock (1967a,b), with later supplementation. Murdock in turn drew on published anthropological descriptions of individual ethnic groups for this and a great deal of other information. There are gaps in the circumcision status data, and doubtless some information was wrong at the time and some other information has since become outdated (De Vincenzi and Mertens 1994; Conant in this Forum). We have attempted to test the circumcision data in three ways. First, we examined one of the large sets of collected reports from which Murdock drew his conclusions (the set in the library of Northwestern University, Evanston, Illinois). Murdock's conclusions with regard to circumcision status seemed to us to be better supported than some of the other information in his *Ethnographic Atlas*, partly because most of the anthropologists from whose research the conclusions were drawn were males in a position to deal with male matters, and partly because the research was carried out largely at a time when traditional African religion was more coherent and when the holding of circumcision camps was still common. Second, we examined as many contemporary ethnographic accounts as possible to ascertain currently reported circumcision status. This was not very rewarding as anthropologists' interests have changed, partly because of the decline to near-extinction of circumcision camps (without a similar decline in circumcision which is now often carried out by doctors, frequently in infancy). Third, we used the opportunity of visits, lectures and seminars across sub-Saharan Africa to raise the question of the current circumcision status of ethnic groups with as many people from different ethnicities as possible. This may not be a very scientific procedure but it may be — as far as we can determine from the literature on the subject — the best current assessment of the situation. Our tentative conclusion is that Murdock's listings were largely correct and that, with relatively few exceptions, they still describe the situation. There are exceptions: the Zulu, alone among the Southern Bantu, gave up circumcision on the orders of Shaka the Great (but, in any case, they are listed by Murdock as not circumcising); small ethnic groups in northwest Botswana, adjacent to larger non-circumcising groups, have given up circumcising; the Akan of southwest Ghana, forming an island in the sea of circumcising peoples of West Africa, have, with the exception of chiefs and their advisers, largely begun circumcising this century; small numbers of the elites have moved in each direction with regard to their infant sons. Much more contemporary documentation on the subject is urgently needed from anthropologists and others, as it is also on clitoridectomy. Nevertheless, the work we have been able to accomplish suggests that it is highly unlikely that there will be any substantial change in the picture drawn from Murdock and others: there is a belt of population stretching from southern Sudan through Uganda, Rwanda, Burundi, part of eastern

Zaire, western Kenya, western Tanzania, Zambia, Malawi, Zimbabwe, Botswana and southern Namibia, approximately 6000 kilometres long and 1000 kilometres wide, the home of almost 100 million people or one-sixth of sub-Saharan Africans, where the vast majority of males are not circumcised; and it is surrounded by populations that do circumcise males. Furthermore, it is probable that, apart from Abidjan and less certainly the rest of CTMte d'Ivoire, this belt, plus the outside cities to which its emigrants go (Nairobi, Mombasa, Tanga, Dar es Salaam, Kinshasa and others), will continue to record the highest HIV surveillance levels in the general population. There have been great changes in the age at which circumcision is carried out (with increasing infant circumcision) and in the circumstances (much more often by doctors), but HIV-transmission risk appears to depend on adult circumcision status and not on the age of circumcision.

(3) The papers did not claim that lack of male circumcision was alone the major determinant of high societal levels of AIDS, but rather that it tipped the balance in circumstances where a whole set of factors came close to permitting an epidemic. In homosexual or drug-taking communities in the West, the high risk of HIV transmission associated with anal sexual intercourse or intravenous injections is sufficient to explain the epidemic. These two behaviours almost certainly play some role in the epidemics in the West Indies and Thailand. But the sub-Saharan African AIDS epidemic — apart from secondary infection in the form of blood transfusion or vertical transmission from mother to child — appears to be almost entirely a heterosexual epidemic even among high-risk core groups. Because of the low risk of HIV transmission between otherwise healthy partners in heterosexual intercourse, purely heterosexual HIV/AIDS epidemics are unusual and depend on a number of concomitant factors. Factors militating against an epidemic in sub-Saharan Africa are the very low level of anal intercourse and of intravenous drug use, a situation fairly definitely established by researchers. Factors favouring an epidemic are levels of premarital and extramarital sexual relations, which, while not above those of the contemporary West (Michael et al. 1994; Wellings et al. 1994), are almost certainly higher than among the peasant societies of North Africa, the Middle East, South Asia and China; and male indulgence in commercial sex, which, while probably not at a higher level than in Thailand, is probably above the levels in much of the world. An important factor making HIV transmission more likely than elsewhere is probably the world's highest regional level of sexually transmitted diseases, at least partly caused by lack of treatment arising from the world's lowest level of health services (World Bank 1994). High levels of chancroid, other genital ulcerating diseases and other STDs mean that HIV transmission can be readily catalysed. The important point is that research to date does not demonstrate that the main AIDS belt is very different from the rest of sub-Saharan Africa by most of these criteria. Indeed, the high-sterility zone of Middle Africa to the westward almost certainly has higher STD levels. What distinguishes the main AIDS belt, and what is almost certainly the factor tipping the balance towards making a high-level sustainable AIDS epidemic possible, is the lack of male circumcision. It might be noted that in other parts of sub-Saharan Africa the epidemic is sustainable among high-risk groups even though the men are circumcised. The explanation is doubtless atypically high levels of sexual partners and untreated STDs. But these restricted epidemics do not spread rapidly through the general population as is the case in the main AIDS belt. Two other factors might be noted. First, because women are farmers rather than traders in East and Southern Africa, in contrast to the West African situation, many of the cities in the East and South have a large surplus of males built up by a predominantly male rural-urban migration stream (Larson 1989). In West Africa this is the case only in Abidjan which receives most of its migrants from the inland savannah where women have less independence than on the coast. The surplus of unattached males undoubtedly means a greater demand for commercial sex. Nevertheless, this situation does not define the main AIDS belt (although it may aggravate the situation in parts of it), because

it is characteristic of only part of it. The Ugandan situation, for example even in Kampala, is one of near-parity in the numbers of the sexes. Second, there is a possibility, which is yet to be confirmed by adequate information on the distribution of STDs in sub-Saharan Africa, that the main AIDS belt might coincide with the major chancroid belt. If so, the explanation is likely to be that lack of circumcision also predisposes males to being infected by chancroid. Finally, it might be noted that the epidemiological demonstration of an association between lack of circumcision and a greater propensity for AIDS infection is not a demonstration of causal mechanisms. It does not demonstrate that lack of circumcision predisposes sexual partners to greater chances of direct infection by HIV; it may predispose them to a greater chance of being infected by chancroid or other genital ulcerating diseases and that in turn may make HIV infection more likely. It does suggest that there is a mechanism, probably biological, that in sub-Saharan African conditions renders societies that practise male circumcision less likely to suffer from a major AIDS epidemic and may render circumcised males in any society less likely to become infected.

(4) The papers also assumed — perhaps because they were written by social scientists rather than medical scientists — that the demonstration of a link between lack of male circumcision and HIV infection was worthwhile even if no practicable intervention program could at the time be envisaged. It was realized that in the main AIDS belt there might prove to be problems in presenting circumcision as an intervention because of the extent to which circumcision or lack of circumcision was connected to traditional culture and religion and its identification with ethnicity. Male circumcision status has long been a divisive force in Kenya. Nevertheless the acceptance of a link between lack of circumcision and a greater likelihood of HIV infection might assist biomedical research, might suggest some public health interventions, and might indicate the relative emphasis that should be placed on interventions throughout the community in contrast to those directed at the high-risk groups. It would also allow elites, or perhaps wider communities, to choose the option of circumcision for themselves or their children. That this is not impossible is shown by the Zulu and Akan experiences. It might allow a more accurate assessment of the risk of epidemics in other parts of the Third World.

Towards agreement

Those responsible for the original epidemiological studies are still convinced of their soundness, and one group is represented in this Forum². The most important aspect of this Forum is, however, the paper by Mertens and Carael, which appears to me to be an important contribution in that it almost brings the debate to a close by assuming that it is likely that the epidemiological case for an association between lack of male circumcision and greater likelihood of HIV infection is correct, and suggesting that the emphasis now should be on cautiously searching for acceptable interventions in this area and stimulating better survey and biomedical research. The paper seems to me to be a balanced appraisal in contrast to De Vincenzi and Mertens (1994) which seemed to do less than justice to the epidemiological evidence. I have little to debate in the detail of their paper³, but I hope the World Health Organization can move to the position of saying that there is sufficient evidence of the

² I.e. the group consisting of Moses, Bradley, Nagelkerke, Ronald, Ndinya-Achola and Plummer. From the other group, Bongaarts, Reining, Way and Conant, the last author also appears in this Forum. Bongaarts is in agreement with our three papers cited here; he has done no further work in this area, at least partly because he regarded the epidemiological studies as conclusive.

³ Carael and Mertens note my use of the word 'lurid' to describe AIDS epidemics as intense as that in the main AIDS belt. If this word seems extreme, it is because I wished to convey to the Durham audience the horror of that epidemic, to which much of the world seems insufficiently responsive.

likelihood of some connection between lack of circumcision and a higher risk of HIV infection for this to be taken into account when organizing interventions and for governments to inform their citizens of this possibility so that they can adopt informed choices. A recent field visit to southwestern Tanzania has taught me that changed circumcision behaviour is more likely than I previously thought and that local populations are ahead of medical researchers in their conclusions. Apparently solely from the observation that circumcising populations have lower levels of AIDS than adjacent non-circumcising ones, increasing numbers of men from the latter groups are presenting themselves and their sons at small rural hospitals for circumcision, and circumcision advertisements are appearing in some Tanzanian newspapers offering a protection from AIDS.

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