

REVIEW

Assessing the role of anal intercourse in the epidemiology of AIDS in Africa

Stuart Brody PhD¹ and John J Potterat BA²

¹Institute of Medical Psychology and Behavioral Neurobiology, University of Tübingen, Germany; ²Colorado Springs, CO, USA

Summary: Public health authorities have long believed that the preponderance of AIDS cases in Africa are attributable to 'heterosexual transmission'; most people silently assume this rubric to indicate penile–vaginal intercourse only. Recent epidemiologic analyses suggest that the majority of HIV cases in sub-Saharan Africa may be due to non-sterile health care practices. The present paper reviews the anthropological, proctologic, and infectious disease literature, and argues that both homosexuality and heterosexual anal intercourse are more prevalent in Africa than has traditionally been believed. The authors hypothesize that perhaps the majority of HIV transmission not accounted for by iatrogenic exposure could be accounted for by unsuspected and unreported penile–anal intercourse. Given the authors' findings, properly conducted studies to measure this HIV transmission vector, while controlling for iatrogenic exposure confound, are clearly warranted in Africa and in countries with similar epidemiologic characteristics.

Keywords: HIV, AIDS, Africa, anal intercourse, heterosexual transmission, homosexuality

Introduction

Public health authorities have long believed that almost all cases of AIDS in African adults are attributable to 'heterosexual transmission' a rubric tacitly understood to refer to penile–vaginal intercourse. This default assumption is reinforced by time-honoured denial of penile–anal practices in Africa. Recent reassessment of epidemiologic evidence indicates that a substantial amount, if not the preponderance, of HIV transmission in sub-Saharan Africa is of iatrogenic origin^{1,2}. In this communication, we review evidence from several sources to support our contention that the majority of HIV transmission not accounted for by iatrogenic exposure could be accounted for by unsuspected and unreported homosexual and heterosexual penile–anal practices. We conclude that properly conducted studies to measure the contribution to HIV transmission of this under-recognized sexual vector are clearly warranted in Africa and in countries with similar epidemiologic characteristics.

In this analysis, we review published evidence about anal intercourse in sub-Saharan Africa, using sources from the anthropological, physiological, and epidemiological literature. Our aim is to emphasize its presence and importance and to

encourage its assessment in infectious disease studies.

Anthropological reports

Recently published anthropological reports document the long and diverse history of homosexuality in multifarious African cultures³. The authors opine that European views of Africans as primitive, and hence 'natural' people fostered the empirically unfounded view of exclusively heterosexual practices in Africa. In the mid-19th century, anecdotal reports of anal intercourse in Africa blamed foreign (especially European and Arabic) influences, or domestic import, especially by neighbouring tribes. The authors, who also provide an appendix with terms for same-sex partners in many indigenous languages, note that anthropologists, when confronted with the reality of homosexuality in Africa, deliberately avoided reporting it for fear of undermining European preconceptions. Anthropologists were aware, for example, of homosexual marriages which entailed 'brideprice' paid to the boy-bride's parents, but remained silent about such unorthodox practices. Distilling information from numerous anthropological reports, including early 17th century observations of homosexuality in Africa by the Portuguese and reports of homosexual marriages among Angolans (noting that 'sodomy was rampant among the people of Angola', Ref. 3, p147), the authors conclude that it was not

homosexuality which was imported to Africa by Europeans but, rather, its intolerance. Not only did this fail to discourage such behaviours but, more importantly, encouraged secrecy and denial by Africans. Despite the 1865 conjecture by David Livingstone that the monopolization of women by tribal leaders led sexually dispossessed men to homosexual behaviour in what is now Zimbabwe, the accounts of contemporary homosexual behaviour across sub-Saharan Africa indicate a striking proportion of bisexual behaviour by males. For example: in 1925 Angola, Falk estimated that 90% of the male population was behaviourally bisexual and 3.5% exclusively homosexual⁴. It is noted by the authors that in many African cultures, it is marriage and reproduction that are universally required, not heterosexual attraction.

Homosexuality in Africa is a virtually taboo subject. Secrecy and misreporting characterize its treatment by observers⁵. Teunis, for example, found his study subjects in Dakar 'by employing that gaze that gay men recognize from one another across many different countries' (p175), and reported that there is much bisexuality among married men, as well as a smaller group of men with feminine mannerisms who apparently practise largely or exclusively receptive anal intercourse. He reported homosexual cultures in different parts of Africa, as did others^{3,6}. Specific instances include reports of homosexual sex between Kenyan truck drivers and teenage boys⁷, and anal intercourse in Zimbabwe⁸. Epprecht⁹ discussed the history of male homosexuality in Lesotho, examining early and mid 20th century homosexual events, including same-sex marriage ceremonies. Halperin¹⁰ noted the informal 'male wife' practice in South African migrant mining camps. Earlier, Fumento¹¹ noted that the American homosexual press reported on the ease with which visitors can find homosexuals in Africa (many of whom are bisexual).

Although it should not be news that prison life frequently entails violence and homosexuality, there have been recent news reports of South African prison gangs using anal rape by HIV seropositives to punish disobedience¹²; of course, the insertive partner must be sufficiently aroused sexually to mete out the punishment.

Anecdotal internet anthropology may be gleaned from an all-African homosexual website¹³ that provides myriad news and personal tales of homosexuality in Africa, including 'a whole village of gay men dressed as women' in Somalia; 'Botswana women said the problems of guys going gay is a matter of concern with others alleging that they have lost their boyfriends who instead opted for gayism' (sic); 'The gay person is looked at primarily as a "gatekeeper"... the link between this world and the other world' in Burkina Faso; a medical researcher in Kenya is quoted as saying: 'Men having sex with men is not only common among young people, but fashionable'; and many

more. In most cases, the male tales refer to behavioural bisexuality.

Perhaps the most important anthropological report of homosexual behaviour in Africa is Lockhart's¹⁴, who studied street boys in Mwanza, Tanzania (a city with a 11.8% adult HIV prevalence). Such a study should raise researchers' index of suspicion for seeking self-reports of, especially, receptive anal intercourse, irrespective of sex. The boys in Mwanza, aged eight to 20, report having anal intercourse with other street boys, as part of initiation rites (i.e., forced receptive anal intercourse, by a gang of boys) into street boy culture and, following acceptance into the street life, occasionally awakening from sleep to find themselves being anally penetrated. Prostitution was rare; anal intercourse was placed in context of belonging to the group, as well as an exercise of power. Anal intercourse with older men known or not known to the street boys was also reported and often attributed to prison rape. By age 18, all boys also reported heterosexual sex; unfortunately, no information regarding heterosexual anal intercourse is provided. None of the boys considered their same-sex intercourse to be a homosexual act¹⁴.

Evidence from pathology: gay bowel syndrome and other conditions

Nearly half a decade before identification of what would be known as AIDS, Sohn and Robilotti¹⁵ published their classic paper 'The gay bowel syndrome', in which they catalogue the symptomatology of male receptive anal intercourse. Symptoms included both infectious (e.g. anal condyloma, *Entamoeba histolytica*-positive stools, rectal gonorrhoea, and hepatitis-A markers) and non-infectious pathologies (e.g., anal fistulas/fissures, haemorrhoids). The authors note 'there are certain physical findings which, while not absolutely diagnostic, should alert the examiner to the possibility of homosexuality' and refer to anal warts as well as other signs, such as diminished anal sphincter tone. The authors also note that many of the homosexual patients reported sex with women or were even married, but also that 10% of patients with anal condylomata denied proctogenital sex. Although both hepatitis and dysentery infections are common in Africa, they are attributed to contaminated water or food and to substandard hygienic practices often noted in developing countries. These infections are almost never assumed to derive from oral-anal sexual contact. Because careful scrutiny of the available African literature suggests signs of 'gay bowel syndrome' even in heterosexual women ostensibly frequently engaging in receptive anal intercourse (see below), researchers' index of suspicion for evidence of such practice should be raised. Apparently, first mention in the medical

literature was the late 19th century observation by Haberlandt¹⁶ of male homosexual prostitutes of Zanzibar (now part of Tanzania): 'Most of them get rectal problems, which they seek to hide in the beginning through kerchief pluggings and applications of perfume' (p 64). More recent reports include the description, in a cohort of 300 patients admitted to a hospital in Nigeria¹⁷, of anal fistulas, anal fissures, and haemorrhoids (this despite a presumably colon-friendly African diet compared with that of New York City homosexual men). Notably, the male-to-female ratio was 4.5:1 for haemorrhoids; 6.5:1 for anal fistulas; and 2:1 for anal fissures. The authors were unable to explain the lopsided sex ratio. It was, in addition, noted that because of the near ubiquity of stool parasites, any association of parasites with haemorrhoids was incidental. A later survey of the general population in Nigeria¹⁸ found a 2.4% prevalence of anal fistulas (all in men), 23.8% prevalence of anal fissures (equally distributed by sex), and a 13.7% prevalence of haemorrhoids. Another report on a series of patients in Nigeria with fistulas¹⁹ noted the presence in several cases of lax anal sphincteric tone. Fistulas have also been attributed to anal sexual abuse of children in Nigeria²⁰.

In theory, the anal pathologies recorded in medical reports could be attributed to infectious disease, or to trauma, not related to anal intercourse. However, the finding that 11% of anal squamous cell carcinomas from a South African sample contained human papillomavirus (HPV) type 16 DNA²¹ points to the presence of anal intercourse. Although the 11% prevalence, unspecified as to sex of the donors, was lower than prevalence from samples obtained in Switzerland, the United Kingdom, and Poland, the level was consistent with prevalence of HPV type 16 in South African cervical cancer biopsies. Other African studies have also reported case studies of rectal, anal, or perianal condyloma²² or their complications²³.

In a 1981 sample of pregnant black women in South Africa, gonorrhoea infection was established by standard culture and confirmatory testing in 11.7% of the 1200 women²⁴. Of the 140 infected women, rectal cultures were positive in 41.6%. Thus 4.8% of the sample was diagnosed with rectal gonorrhoea. Predictably, given belief about strict heterosexuality in Africa, the authors report their belief that anal intercourse is rare in their patient population. Such an attitude, if pervasive among clinicians in Africa, may explain the dearth of sexually transmitted infections studies in Africa that include rectal culture or examination.

Epidemiological reports

Studies of self-reported behaviours perceived as pejorative or as socially undesirable undoubtedly contain misreports²⁵⁻²⁷. There is ample evidence of

such under-reporting, particularly of homosexual or anal intercourse behaviours, in North American and European surveys. Given our understanding of social mores in sub-Saharan Africa and given criminal codes against such practices in most of these countries, one expects such behaviours to be less likely to be reported than in North America or Europe; thus blanket denials of anal intercourse in surveys from Africa probably reflect cultural reluctance, as well as (foreign?) researchers' low index of suspicion and, perhaps, personal reluctance. As for reluctance among Africans, Falk²⁸, referring to male homosexual behaviour of the Wawihe tribe of Angola, observed in 1923: '... while the act is permitted, speaking about it is considered disgusting' (p 168).

Studies in both North America and Europe have shown that use of specific technologies usually result in either the detection of misreport²⁷ or increased likelihood that subjects admit to experience with receptive anal intercourse; for example, one study reports that women were 800% more likely to admit having experienced anal intercourse to a computer questionnaire than to a human interviewer²⁹. Unfortunately these approaches have not been widely used in Africa. However, when South African prostitute diary recordings of sexual behaviour were compared with their recalled behaviour frequencies (the latter is more commonly used when studying sexual behaviour in Africa), the diaries led to a frequency of anal intercourse 387% (with partners) to 400% (with clients) higher than the estimate produced by recall estimates. Although other sexual acts were also underreported with the recall estimate, for clients anal intercourse was the most underestimated³⁰.

Immunological abnormalities were reported in eight of 10 South African 'self-confessed homosexuals' examined in 1983 (p 119)³¹. In a 1985 report on 'slim disease' in Uganda, it was noted that the first reported positive human T-cell lymphotropic virus type III cases occurred in Tanzanian traders, who reported having both heterosexual and homosexual activity (without any query regarding the details of those activities)³². More recently, 42% of a sample of South African truck drivers admitted to engaging in heterosexual anal sex³³. Fourteen percent of prostitutes studied in a Kenyan sample admitted to anal intercourse (in addition, 3% admitted to injecting drug use)³⁴. Nearly half (42.8%) of prostitutes in a South African sample admitted engaging in anal sex; their HIV prevalence was 61.3%, compared with 42.7% in prostitutes who denied anal sex³⁵. Nine percent of male and female students in a Tanzanian study reported that anal intercourse was their first sexual act³⁶, while 18% of males (and 44% of females) in a Senegalese survey reported homosexual experience³⁷. Twelve percent of female college students in a Togo study reportedly had experienced anal intercourse³⁸. In Zimbabwe, 35% of a large representative sample⁸ of persons aged 18-27

reported having engaged in anal intercourse in the preceding two months.

In a multicentre study in sub-Saharan Africa, female prostitutes were asked about anal intercourse with their most recent client, and allowed to respond in both a direct (yes/no) and in a vague manner ('women reporting several types of intercourse without specifying what they were', p S64). Few of the women (0 to 4%) responded directly. Allowed to answer indirectly, 2–11% answered affirmatively, with higher rates in cities with higher HIV prevalences³⁹. Regrettably, these prostitutes were not queried about longer time frames than last client.

In a multicentre study evaluating the effects of a spermicidal cream on HIV transmission in African prostitutes, the baseline self-reported anal intercourse rates were associated with seroconversion risk on a location basis (the authors did not provide correlations for individual anal intercourse risk of seroconversion, or even discuss the issue of anal intercourse rates being associated with seroconversion risk⁴⁰). In Durban, South Africa, the baseline anal intercourse rate was 41% (the HIV seroconversion rate at that location was 16–26 per 100 woman-years; the range reflects rates in the two spermicidal conditions), in Cotonou, Benin, the baseline anal intercourse rate was 8% and seroconversion rate 8–11%, and in Abidjan, Côte d'Ivoire (Ivory Coast), the baseline anal intercourse rate was '<5%', and seroconversion rate 0–7%. The admitted anal intercourse rate had climbed to 75% at the time of follow-up in the South African sample, but no such data were provided for the other sites.

In a Zambian prison⁴¹, 8.4% of inmates admitted to having experienced homosexual anal intercourse, 'although indirect questioning suggested a much higher figure' (p 1388), and all such men reported active heterosexual relationships outside of prison (none used condoms for homosexual anal intercourse). Finally, in a Nigerian prison, 53% of the men reported sex with men while imprisoned⁴². The street boys of Tanzania reported a near-universality (98.7%) of receptive anal intercourse¹⁴, consistent with earlier studies cited by the investigator.

Discussion

Our inquiry into the available, admittedly sparse, published literature suggests that anal intercourse is much more common in the populations living in sub-Saharan Africa than customarily suspected or reported by clinicians and researchers. Africans, like people from the rest of the world, apparently have significant experience with homosexual and heterosexual anal intercourse. Indeed, as noted above, in some African samples, prevalence might actually be higher than typically reported elsewhere in the world. What is noteworthy about

male homosexuality in Africa is its most common form of expression: bisexuality. If such men have anal intercourse with women, or if the integrity of cervico-vaginal epithelium in their female partners is compromised by genital ulcer diseases, especially syphilis, the efficient sexual transmission of HIV is undoubtedly facilitated.

We found no evidence for some practices reported from North America and Europe, such as 'fisting' or similar parasexual procedures that enhance HIV transmission⁴³. However, tribal enemas are part of traditional medicine in southern Africa; in some tribes such enemas are administered as often as 50 to 100 times annually and may contain toxic substances which can inflict colon damage⁴⁴, possibly enhancing HIV transmission.

With the possible exceptions of cities like Johannesburg and Cape Town in South Africa, the presence of gay venues offering multi-partnered sex that were important for rapid HIV transmission in New York City and in San Francisco are apparently absent in sub-Saharan Africa. Consequently, there are probably few African men who have experienced the accumulation of hundreds of partners frequently reported in North American and European studies, particularly in the early days of the AIDS epidemic^{11,27}. This putative difference may limit the magnitude of 'sexual' HIV transmission in Africa. Good studies need to be conducted, particularly in light of reports such as Falk's in the 1920s: a physician caring for miners told Falk that one of his male patients presented 'with a totally ripped, bleeding anus' (p 189) after a night of prostitution with 45 clients⁴.

Given recent reassessment of AIDS epidemiology in parts of Africa, behaviours most relevant to its transmission there (and probably in much of the Third World) seem less likely to be sexual than a consequence of unhygienic practices and medical care. Intriguingly, the virtual gender parity in the distribution of AIDS cases in Africa is consistent not only with suspected health care transmission^{2,11}, but with presumably widespread male bisexuality⁴⁵.

The purpose of this presentation is to present evidence that, despite consistent denials to the contrary, homosexuality and heterosexual anal intercourse may be common in sub-Saharan Africa, and that African AIDS cases not attributable to health care exposures may well be due primarily to anal intercourse. We suspect that modern day denial of heterosexual anal intercourse is exacerbated by the exigencies of AIDS propaganda and politics ('It's everybody's disease').

That persons of reproductive age with healthy genitals are not likely to acquire HIV from unprotected penile-vaginal intercourse²⁷ is substantially supported by Greenhead and colleagues⁴⁶; they show that, in punch biopsies of vaginal and cervical tissue inundated with HIV for six to 24 hours, HIV was unable to penetrate or

infect healthy vaginal or cervical tissue. Notably, intestinal tissue subjected to similar treatment was readily infected, an observation which is consistent with known ease of HIV transmission via anal intercourse. Of course, women who are manifestly unhealthy, such as those with syphilitic chancres compromising the integrity of the vagina, run a significant risk from vaginal intercourse^{47,48}.

In one respect, the epidemiology of AIDS in Africa might be similar to that in the First World: injections and anal intercourse appear to be the primary conduits for HIV transmission^{25–27,49}, a major difference being that parenteral transmission in the First World stems from conscious sharing of needles for injecting illicit drugs, whereas in Africa and, likely, other Third World venues, much transmission seemingly results from iatrogenic exposure with its inadvertent sharing of medical sharps.

It is noteworthy that the street boys of Tanzania, nearly all of whom reported receptive anal intercourse, reported that AIDS could be transmitted by sexual intercourse, but all denied its transmission via their own receptive anal intercourse, because that practice did not involve a woman¹⁴. Failure of public health messages to differentially warn about the known dangers of anal, as opposed to vaginal, intercourse has a seemingly political rather than scientific origin. Political correctness and its ally, gullibility, has led to acceptance of the socially desirable but undocumented claim by some clinicians and researchers that neither homosexuality nor heterosexual anal intercourse occurs frequently in sub-Saharan Africa. The time has come to conduct proper scientific studies to assess the true magnitude not only of iatrogenic HIV transmission, but of its specific sexual routes.

Note: We prepared this manuscript without any financial support and have no conflicts of interest in connection with this research.

References

- Gisselquist D, Rothenberg R, Potterat J, Drucker E. HIV infections in sub-Saharan Africa not explained by sexual or vertical transmission. *Int J STD AIDS* 2002;**13**:657–66
- Gisselquist D, Potterat JJ, Brody S, Vachon F. Let it be sexual: How health care transmission of AIDS in Africa was ignored. *Int J STD AIDS* 2003;**14**:148–61
- Murray SO, Roscoe W, eds. *Boy-wives and female husbands: studies of African homosexualities*. New York: Palgrave, 2001
- Falk K. Homosexuality among the natives of Southwest Africa. In: Murray SO, Roscoe W, eds. *Boy-wives and female husbands: studies of African homosexualities*. New York: Palgrave, 2001 (pp 187–96) (chapter originally published 1925)
- Teunis N. Same-sex sexuality in Africa: a case study from Senegal. *AIDS Behav* 2001;**5**:173–82
- Gevisser M, Cameron E, eds. *Defiant desire: gay and lesbian lives in South Africa*. New York: Routledge, 1995
- HIV and Kenya's homosexuals [Editorial]. *Afr Health* 1998;**20**:48
- Akande A, Muvakure G, Nyanhete P, Williams B, Chitumba B, Chakamanga D. AIDS high-risk and precautionary behaviour in young African adults: a Zimbabwean perspective. *Early Child Dev Care* 1993;**88**:73–85
- Eprecht M. Male–male sexuality in Lesotho: two conversations. *J Men Stud* 2002;**10**:373–89
- Halperin DT. Heterosexual anal intercourse: prevalence, cultural factors, and HIV infection and other health risks, Part I. *AIDS Patient Care STDS* 1999;**13**:717–30
- Fumento M. *The myth of heterosexual AIDS*. Washington DC: Regnery Gateway, 1993
- HIV 'slow puncture' used by prison gangs [News]. Available from: URL: http://www.sabcnews.com/south_africa/crime1justice/D,1009,47735,00.html (accessed 10 March 2003)
- 'Behind the mask'. Website with various links. Available from: URL: <http://www.mask.org.za> (accessed 29 November 2002)
- Lockhart C. Kunyenga, 'real sex', and survival: assessing the risk of HIV infection among urban street boys in Tanzania. *Med Anthropol Q* 2002;**16**:294–311
- Sohn N, Robilotti JG. The gay bowel syndrome. *Am J Gastroenterol* 1977;**67**:478–84
- Haberlandt M. Contrary-sex among the Negro population of Zanzibar. In: Murray SO, Roscoe W, eds. *Boy-wives and female husbands: studies of African homosexualities*. New York: Palgrave, 2001 (pp 63–5) (chapter originally published 1899)
- Ajayi OO, Banigo OG, Nnamdi K. Anal fissures, fistulas, abscesses, and hemorrhoids in a tropical population. *Dis Colon Rectum* 1974;**17**:55–60
- Ani AN. Anorectal diseases in Western Nigerian adults. *Dis Colon Rectum* 1983;**26**:381–5
- Akinola DO, Hamed AD. Fistula in ano in Nigerians. *Trop Gastroenterol* 1989;**10**:153–7
- Ameh EA. Anal injury and fissure-in-ano from sexual abuse in children. *Ann Trop Paediatr* 2001;**21**:273–5
- Scholefield JH, Kerr IB, Shepard NA, Miller KJ, Bloomfield R, Northover JMA. Human papillomavirus type 16 DNA in anal cancers from six different countries. *Gut* 1991;**32**:674–6
- Okesola AO, Fawole OI. Prevalence of human papilloma virus genital infections in sexually transmitted diseases clinic attendees in Ibadan. *West Afr J Med* 2000;**19**:195–9
- Yedomon HG, Hodonou R, Do Ango-Padonou F, Akpo C, Goudote E, Bourlond A. Tumeur de Buschke–Löwenstein. A propos de deux cas vus à Cotonou, Bénin. [Buschke–Löwenstein tumor. Apropos of 2 cases in Cotonou, Benin]. *Bull Soc Pathol Exot* 1997;**90**:184–5
- Welgemoed NC, Mahaffey A, Van den Ende J. Prevalence of *Neisseria gonorrhoeae* infection in patients attending an antenatal clinic. *S Afr Med J* 1986;**69**:32–4
- Brody S. Lack of evidence for transmission of human immunodeficiency virus through vaginal intercourse. *Arch Sex Behav* 1995;**24**:383–93
- Brody S. Patients misrepresenting their risk factors for AIDS. *Int J STD AIDS* 1995;**6**:392–8
- Brody S. *Sex at risk: lifetime number of partners, frequency of intercourse, and the low AIDS risk of vaginal intercourse*. New Brunswick, NJ: Transaction Publishers, 1997
- Falk K. Same-sex life among a few Negro tribes of Angola. In: Murray SO, Roscoe W, eds. *Boy-wives and female husbands: studies of African homosexualities*. New York: Palgrave, 2001 (pp 168–70) (chapter originally published 1923)
- Gross M, Holte SE, Marmor M, Mwatha A, Koblin BA, Mayer KH. Anal sex among HIV-seronegative women at

- high risk of HIV exposure. *J Acquir Immune Defic Syndr* 2000;**24**:393–8
- 30 Ramjee G, Weber AE, Morar NS. Recording sexual behavior: comparison of recall questionnaires with a coital diary. *Sex Transm Dis* 1999;**26**:374–80
- 31 Anderson R, Prozesky OW, Eftyichis HA, van der Merwe MF, Swanevelder C, Simson IW. Immunological abnormalities in South African homosexual men. *S Afr Med J* 1983;**64**:119–22
- 32 Serwadda D, Mugerwa RD, Sewankambo NK, *et al.* Slim disease: a new disease in Uganda and its association with HTLV-III infection. *Lancet* 1985;**2**:849–52
- 33 Ramjee G, Gouws E. Prevalence of HIV among truck drivers visiting sex workers in KwaZulu-Natal, South Africa. *Sex Transm Dis* 2002;**29**:44–9
- 34 Fonck K, Kaul R, Kimani J, *et al.* A randomized, placebo-controlled trial of monthly azithromycin prophylaxis to prevent sexually transmitted infections and HIV-1 in Kenyan sex workers: study design and baseline findings. *Int J STD AIDS* 2000;**11**:804–11
- 35 Karim SS, Ramjee G. Anal sex and HIV transmission in women. *Am J Pub Health* 1998;**88**:1265–6
- 36 Matasha E, Ntembelea T, Mayaud P, *et al.* Sexual and reproductive health among primary and secondary school pupils in Mwanza, Tanzania: need for intervention. *AIDS Care* 1998;**10**:571–82
- 37 Schenkel R. Le vécu de la vie sexuelle chez les Africains accultures du Sénégal. *Psychopathologie Africaine* 1971;**7**:313–58. Cited in: Murray SO, Roscoe W, eds. *Boy-wives and female husbands: studies of African homosexualities*. New York: Palgrave, 2001:107
- 38 Sallah ED, Grunitzky-Bekele M, Bassabi K, *et al.* [Sexual behavior, knowledge and attitudes to AIDS and sexually transmitted diseases of students at the University of Benin (Togo)]. *Santé* 1999;**9**:101–9 (cited in Halperin, 1999)
- 39 Morison L, Weiss HA, Buve A, *et al.* Commercial sex and the spread of HIV in four cities in sub-Saharan Africa. *AIDS* 2001;**15**(Suppl 4):S61–9
- 40 Van Damme L, Ramjee G, Alary M, *et al.* Effectiveness of COL-1492, a nonoxynol-9 vaginal gel, on HIV-1 transmission in female sex workers: a randomised controlled trial. *Lancet* 2002;**360**:971–7
- 41 Simooya O, Phiri A, Sanjobo N, Sichilima W. Sexual behaviour and issues of HIV/AIDS prevention in an African prison. *AIDS* 1995;**9**:1388–9
- 42 Okochi CA, Oladepo O, Ajuwon AJ. Knowledge about AIDS and sexual behaviors of inmates of Agodi prison in Ibadan, Nigeria. *Int Q Community Health Educ* 1999–2000;**19**:353–62 [Abstract]
- 43 Winkelstein W, Lyman DM, Padian N, *et al.* Selected sexual practices and risk of infection by the human immunodeficiency virus. *JAMA* 1987;**257**:321–5
- 44 Dunn JP, Krige JE, Wood R, Bomman PC, Terblanche J. Colonic complications after toxic tribal enemas. *Br J Surg* 1991;**78**:545–8
- 45 Padian N, Pickering J. Female-to-male transmission of AIDS: a reexamination of the African sex ratio of cases. *JAMA* 1986;**256**:590
- 46 Greenhead P, Hayes P, Watts PS, Laing KG, Shattock RJ. Parameters of human immunodeficiency virus infection of human cervical tissue and inhibition by vaginal virucides. *J Virol* 2000;**74**:5577–86
- 47 Potterat JJ. Does syphilis facilitate sexual acquisition of HIV? *JAMA* 1987;**258**:473–4
- 48 Rabkin CS, Thomas PA, Jaffe HW, Schultz S. Prevalence of antibody to HTLV-III/LAV in a population attending a sexually transmitted diseases clinic. *Sex Transm Dis* 1987;**14**:48–51
- 49 Brody S. Heterosexual transmission of HIV. *N Engl J Med* 1994;**331**:1718

(Accepted 22 February 2003)