

The making of HIV epidemics: what are the driving forces?

Michel Caraël, Anne Buvé* and Kofi Awusabo-Asare[†]

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Introduction

AIDS among patients from sub-Saharan Africa was first reported in the scientific literature in 1983 [1–3]. These patients did not share the main risk factors associated with the disease in European and North American patients, that is, principally homosexual intercourse and intravenous drug use. It soon emerged that the epidemiology of AIDS in Africa was quite different from that found in Europe and North America; heterosexual intercourse, blood transfusion and mother-to-child transmission were the predominant modes of transmission [4]. While less common risk behaviours, such as intravenous drug use and unprotected homosexual intercourse, can be targeted with interventions aimed at reducing the risks, it is harder to design interventions for the much larger population engaging in heterosexual intercourse.

Researchers have spent much of the last 15 years trying to identify the forces that have propelled HIV through the heterosexual population in much of sub-Saharan Africa. While the virus has generally spread rapidly, the infection appears to have stabilized at very different levels in different areas and communities, and there is still no clear explanation for why this should be so [5]. Early studies focused on individual behaviours and found that HIV infection was associated with multiple sex partners, commercial and casual sex, and a history of other sexually transmitted diseases. However, there is a growing awareness that this approach has its limits. While it can explain who is more likely to be infected in a given population, it is less able to explain why some populations sustain far higher levels of infection than others. Answering the latter question requires the study of population characteristics rather than characteristics of the individual [6].

As a result, AIDS research and associated intervention programmes are increasingly focusing on social environments, gender relations, human rights and socioeconomic development as determinants of the spread of HIV. In other words, researchers are increasingly looking not just at behaviours which put people at risk of HIV infection, but at the social, economic and cultural situations which encourage or prevent those behaviours [7–9]. From this broader line of enquiry has emerged a profusion of concepts that have formed the basis of interventions or recommendations. Some of them, such as covariates, rely on a weak association between markers of risk; others, such as root causes, draw strong causal links between social structure and HIV infection. In between lie concepts that attempt to elucidate enabling factors or the pathways through which the sociocultural landscape is linked to specific risk situations.

It is clear that any social or cultural factor must work through a physical 'proximate determinant' which puts someone at risk of HIV infection. Poverty, for instance, cannot cause AIDS; however, poverty may well create a reliance on income from casual sex partners that in turn puts a man or woman at risk of contracting AIDS. There are endless other potential links between poverty and poor health. However, so far no clear theoretical framework exists to link behaviours that make people vulnerable to HIV infection with background social, cultural and economic landscapes.

The search for the socioeconomic and cultural roots for specific health problems or behaviours is by no means confined to HIV [10–12]. In the field of childbearing, for instance, a debate has dragged on for years over whether a decline in fertility can be triggered by the provision of contraceptive services alone, or whether economic

From the Joint United Nations Programme on HIV/AIDS (UNAIDS), Geneva, Switzerland, the *STD/HIV Research and Intervention Unit, Institute of Tropical Medicine, Antwerp, Belgium and the [†]Department of Geography and Tourism, University of Cape Coast, Ghana.

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Requests for reprints to: Dr Michel Caraël, Department of Policy, Strategy and Research, UNAIDS, 20 avenue Appia, CH-1211 Geneva 27, Switzerland.

development is a prerequisite for smaller families. These debates are of more than academic importance as they have important implications for resource allocation and potential effectiveness and sustainability of interventions. In the context of HIV, a country with limited resources may be faced with competing choices between putting resources into condom distribution, improving sexually transmitted disease (STD) case management, or subsidizing education to keep girls in school longer. A better understanding of what determines or influences sexual behaviour should give clues to the types of intervention that are most likely to be effective in a given context, within different time frames.

This paper briefly describes the principal approaches taken so far to identify what drives HIV infection. The strengths and weaknesses of each approach and their implications for interventions are discussed. We recognize that, in categorizing work to date, we have to oversimplify and are bound to ignore the nuances distinguishing different views and concepts.

The epidemiological approach

Epidemiologists tend to focus on the behaviours which directly determine whether or not someone will become infected with HIV; in other words, epidemiologists concentrate on the proximate determinates of infection. In attempting to answer the question 'why did this patient get this disease at this time?' [6], epidemiologists look at a number of risk factors: genetic, biological and/or behavioural. This approach has led to the identification of the modes of transmission of HIV. It is now generally accepted that in sub-Saharan Africa over 80% of HIV infections in adults are transmitted through intercourse between men and women [13]. Evidence for this epidemiological pattern was first provided by studies of the age and sex distribution among AIDS cases in sub-Saharan Africa. Case-control studies and studies of patterns of infection within sexual partnerships found that certain sexual behaviours, such as frequent partner change and commercial sex, were associated with HIV infection. People with a previous history of STD were also more likely to be infected with HIV than those with no such history [4].

Research in the United States and in Europe has found that the transmission of HIV via heterosexual contact is rather low, the transmission probability per sex act being less than one in a thousand [14]. Thus the extent of the spread of the virus in the general heterosexual population in sub-Saharan Africa and other developing countries has been, and still is to a certain extent, rather puzzling.

The gaps in understanding of the dynamics of the spread of HIV in sub-Saharan Africa have led some researchers to challenge the idea that the predominant mode of transmission on this continent is intercourse between men

and women [15,16]. Packard and Epstein [16], for example, suggested that the transposition of Western ideas about AIDS may have narrowed research questions on AIDS in Africa, with a consequent limitation of the possible explanations of the rapid spread of HIV in Africa. They proposed that more attention should be paid to the role of blood transmission and transmission through contaminated needles and skin-piercing instruments, but neither of these is convincing. On the basis of epidemiological studies, it has been estimated that in sub-Saharan Africa as many as 5–10% of HIV infections may be the result of blood transfusion, with women and children being at greatest risk of becoming infected in this way. The relative absence of HIV infections among children aged 5–15 years, however, suggests that parental transmission is not an important factor in the epidemic spread of HIV in Africa. Another suggested factor, malnutrition, could in theory be implicated as a facilitating factor in HIV transmission, but so far there is no evidence for such a role.

At the present time, most researchers agree that there are two broad epidemiological explanations for the differences in the rate of spread of HIV in various heterosexual populations. A first possible explanation is that the per sex act probability of HIV transmission is much higher in high prevalence areas than in areas where the epidemic has remained at low levels. Secondly, and this does not exclude the first possible explanation, there could be large differences in sexual behaviour patterns; the probability of exposure to an HIV-infected person is much higher in regions where the HIV epidemic has had an explosive course.

Factors affecting the transmission of HIV through heterosexual intercourse

A lot of research has focused on the identification of co-factors that facilitate or hamper the transmission of HIV (Table 1). It is now well established that 'other' STD (such as genital ulcer disease as well as urethritis and cervicitis) facilitate the sexual transmission of HIV. Evidence for the facilitating role of other STD was first provided by epidemiological studies on risk factors for HIV seroconversion [17,18] and confirmed by a controlled intervention trial which found a 40% reduction in the incidence of HIV infection in the general population of the Mwanza region, Tanzania, as a result of improvement in the case detection and management of STD [19]. The latest evidence comes from biological studies which have found enhanced shedding of HIV in genital secretions in the presence of another STD, which is reversible after treatment of the STD [20,21].

Other STD (including chancroid, syphilis, gonorrhoea and chlamydial infection) are certainly more common in most regions of sub-Saharan Africa than in Europe and in North America. It is also striking that ulcerative STD are much more prevalent in eastern and southern Africa

Table 1. Biological factors increasing the probability of sexual transmission of HIV.

Confirmed
Acute primary HIV infection
Advanced clinical stage of HIV
Sexually transmitted diseases
Anal intercourse
Menstruation
HIV-1 versus HIV-2
Under study
Lack of male circumcision
Hormonal contraception
Cervical ectopy
Genital trauma (use of vaginal products)
Specific HIV-1 clades

that in western Africa. But it remains unclear how far the interaction between 'other' STD and HIV infection can explain the large differences in epidemic spread which exist between different regions of Africa, and between Africa and Europe and North America. It has been estimated that over 80% of HIV infections in men in Nairobi are attributable to genital ulceration [22]. Using data from Uganda, Robinson *et al.* [23] have estimated that, early in the epidemic, over 90% of new HIV infections were attributable to other STD. More research is needed to confirm these estimates and, in particular, to assess the respective roles of co-factors and sexual behaviour patterns in shaping HIV epidemics.

A second co-factor, less clearly demonstrated and still much debated, is male circumcision. Several ecological studies reported a strong association between lack of male circumcision and HIV prevalence; areas of Africa with a large number of uncircumcised men were associated with regions suffering from the most severe AIDS epidemic [24,25]. This association may represent a causal effect or may be due wholly or partly to the influence of non-exclusive confounding or intermediate variables such as sexual behaviours, genital cleanliness and/or susceptibility to other STD [26]. While circumcision in men has been shown to be associated with a decreased risk of acquiring genital ulcerative diseases [27], epidemiological studies have been less consistent in demonstrating its protective effect against HIV infection [28,29].

Studies on discordant couples in the United States and in Europe have found sex during menses and anal intercourse to be associated with an increased risk of transmission [30,31]. There is strong evidence from the vast anthropological literature and survey results, however, that these practices have not played a significant role in the spread of HIV in sub-Saharan Africa [32,33]. There are, however, other practices which could increase the per-

sex act transmission probability and which are known to be common in some areas. The best documented of these practices is 'dry sex', in other words the use of drying agents in the vagina. This could in theory be associated with an increased risk of HIV transmission but, so far, there is no convincing epidemiological evidence for an association between 'dry sex' and HIV infection. Nevertheless, this practice could be an important obstacle for condom use [34–37].

A third factor that may account for the differential spread of HIV is differences in the transmissibility and virulence of various HIV strains. There is strong evidence that HIV-1 is more transmissible than HIV-2 [38] and *in-vitro* studies, as well as couple studies from Thailand [39], have suggested that the HIV-1 subtype E is more easily transmitted during intercourse between men and women than the HIV-1 subtype B. So far, however, current evidence of biological differences between different HIV-1 subtypes seems inconclusive [40,41]. The recent observation that some sex workers repeatedly exposed to HIV infections remained HIV antibody-negative led to the hypothesis that some persons may have a weaker susceptibility or even immunity against the virus or specific subtypes [42]. The role of factors such as certain human leukocyte antigen haplotypes and, more recently, chemokine receptor gene *CCR5* to explain such resistance has been mentioned but there is still no conclusive evidence. Despite the extensive research performed on biological factors of HIV, both in Africa and in the West, no single factor except STD seems to provide plausible and convincing explanations for the rapid spread of HIV in parts of Africa compared to the rest of the world.

Sexual behaviour patterns

Early in the HIV/AIDS epidemic in sub-Saharan Africa, high rates of partner change and commercial sex were identified as individual risk factors for HIV infection. In towns with a large proportion of men having sex with sex workers, such as Kigali in Rwanda, HIV has spread much faster in the general population than in cities such as Kinshasa in Zaïre where commercial sex is much less common [43]. This is consistent with results of simulations with mathematical models which suggest that patterns of sexual behaviour, whereby men have sex with a small group of highly sexually active women and some contact with low activity women, lead to explosive epidemics [44]. Sexual asymmetry where most women report few sexual partners and many men have multiple partners has been found in nearly all studies on sexual behaviour but there are important variations in the level of asymmetry. Studies have also shown a progressive delay in the age at which females and males first marry or enter a stable partnership, and this extends the length of time during which pre-marital sex can occur. This may have an impact on the difference in sexual behaviour between men and women [45,46].

More recently it has been suggested that for the same rate of partner change concurrent partnerships are more efficient for the propagation of the virus than serial relationships [47,48]. Indeed, in overlapping relationships, it takes less time for the virus to spread between partners. In addition, contrary to serial partnerships, earlier partners are still exposed if the subject becomes later exposed to the virus [49]. Another contributing factor to this effect of concurrency may be biological. The high levels of HIV viraemia found in the initial and late stages of HIV/AIDS are believed to be correlated with heightened infectiousness [50,51]. As the duration of infectiousness is limited, more people will become infected in the context of prostitution or with a network of overlapping sexual partnerships than if there is a pattern of serial relationships.

There is as yet little systematic information on sexual networks which could help confirm or refute these hypotheses. A series of cross-sectional, population-based studies on sexual behaviour which have been conducted under the leadership of the World Health Organization Global Programme on AIDS in 1989–1991 revealed important differences in age at first sexual intercourse, interval between first sex and first regular union (Table 2), rates of sexual partner change and, even more importantly, rates of non-regular and commercial sex relationships [46,47] (Fig. 1). For example, the percentage of men who reported sex with non-regular partner in the last 12 months ranged from 8% in Burundi to 51% in Côte d'Ivoire; the corresponding percentages for women were 2% and 13%. The number of men who reported commercial sex (sex in exchange for money or gifts) in

Table 2. Age at first sex and duration of sexual exposure before first marriage.

	Côte d'Ivoire	Kenya	Tanzania	Lusaka, Zambia
Median age at first sex (years)				
Men	16.7	17.2	17.3	16.6
Women	15.8	17.2	17.2	17.3
Mean time before first marriage (years)				
Men	4.7	6.8	4.7	4.3
Women	0.8	2.1	0.8	1.3

the last 12 months in relation to the total number reporting non-marital sex of any kind provides a reasonable indication of the contribution of commercial sex to all non-marital encounters. It ranges from 20% for men in Côte d'Ivoire to more than 70% in the Central African Republic. These data indicate that important differences in mixing patterns and in frequency of concurrent partnerships exist which may explain some of the observed variations in the rate of spread of HIV in different regions of sub-Saharan Africa.

Epidemiological research has made important contributions to the identification of proximate determinants of HIV infection, including sexual and other behaviours which directly affect the likelihood of becoming infected. However, it tells us little or nothing about the social, economic and cultural factors which influence how people behave.

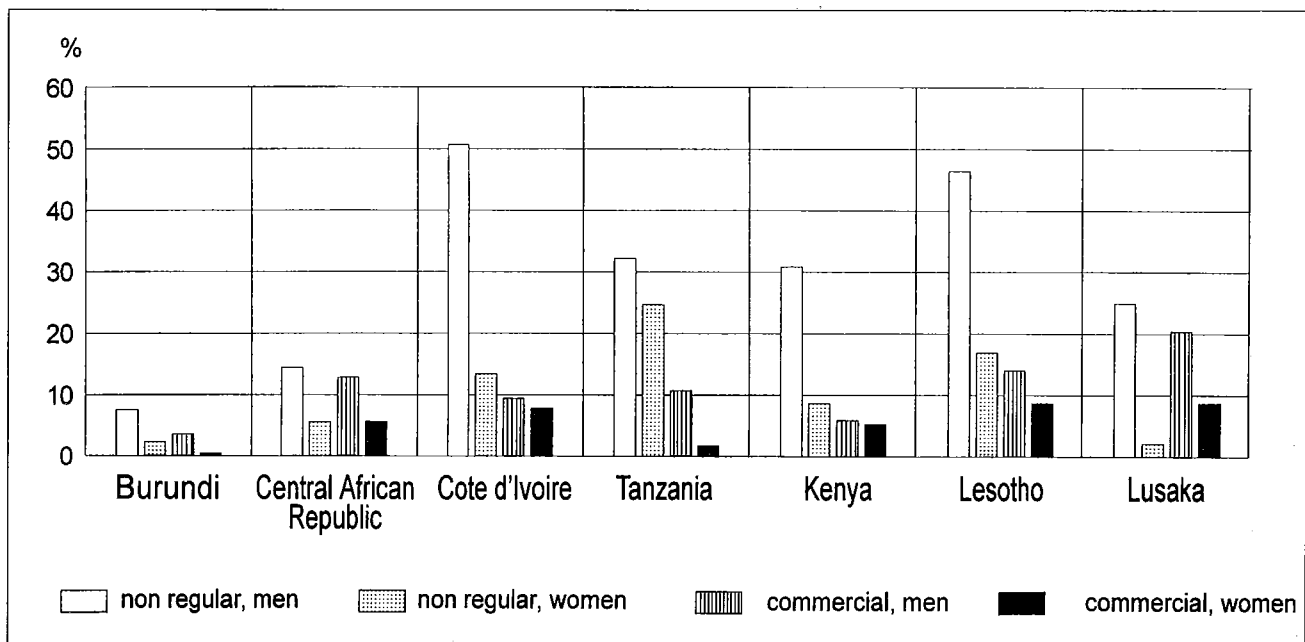


Fig. 1. Percentage of 15–49-year-old men and women who reported non-regular and commercial sex in the past 12 months. Adapted with permission from [46].

The cultural approach

The cultural approach takes a step back from the direct causes of infection and focuses instead on the cultural factors that influence sexual norms and behaviour. It suggests that traditions of family formation and the expectations that men and women have of one another and of society are the prime factors dictating the sexual behaviours that put people at risk of contracting HIV. 'Culturalists' argue that, while there is a wide diversity of cultures in sub-Saharan Africa, in most societies social relationships are dictated by a tightly bound network of kinship and marriage which dominate, shape and constrain individuals' beliefs and sexual practices. Many aspects of African marriage systems strongly influence sexual behaviour. Polygyny, easy remarriage, post-partum sexual abstinence and long periods of spousal non-cohabitation tend to favour high rates of partner exchange [52]. An emphasis on high fertility and the primacy of parenthood mitigate against widespread consistent use of condoms, while strong ties to natal family groups may prevent the development of close and mutually exclusive emotional ties between husband and wife and therefore favour multiple partnerships [25,53]. The status of women is also partially contingent upon various patterns of kinship organization that determine whether there is more or less access to the market economy and other independent sources of income. In strictly patrilineal societies, widow-inheritance has been the rule; passing on wives, children and property to the brothers or family members of dead husbands remains common in Uganda, Kenya, but also in other societies in west Africa [54,55]. In patrilineal societies, social restrictions on the sexual lives of women tend to be particularly strong, limiting their opportunities for pre- or extra-marital sex. Often, men are not subjected to the same constraints. Where polygamy is common, a small pool of older men with access to resources may dominate a much larger pool of younger women. This creates a large age gap at marriage; many younger men who have no immediate hope of finding a wife are left to find sex outside a low-risk regular partnership, a situation which encourages commercial sex in many cultures. Men may also acquire new partners during their wives' long periods of culturally prescribed abstinence, such as that following childbirth.

It is frequently argued that social changes (such as education, urbanization, exposure to the media and an increasingly cash-based economy) necessarily break down cultural norms and traditions. However area-specific studies describe the adaptation of ethnic or cultural identities over decades to the constraints and demands of new environments [56,57]. Frequently, the changes perceived to follow from modernization are found to be less dramatic than initially supposed. Cross-cultural survey results showed that disparities in sexual behaviour between urban and rural areas, after control for age and marital

status, were considerably less than expected. This suggests that sexual behaviour in most urban strata is still considerably influenced by the patterns of sexual mixing initially established in rural cultures [58,59].

Several studies emphasize that cultural practices do not exist in isolation. They form part of an integrated system, supported by powerful religious and social beliefs. Polygyny, sexual abstinence, a wide age gap at marriage and a dominance of the marriage market by wealthy men all form part of a self-reinforcing structure [60–62]. Because social values are interlinked and reinforce one another, the institutions they give rise to frequently outlast the particular forces that shaped them. Post-partum abstinence, for instance, continues to be common even among women whose adoption of modern contraceptives have rendered its initial function as a method of birth-spacing superfluous. This illustrates the lasting hold which culture has over behaviour. Cultural institutions are no more immutable than individual behaviour, however, as several anthropologists have pointed out. Possibilities exist in many kinship systems for extra-marital affairs to compensate for prescribed marital relationships that do not fulfil the needs of either partner. Polygyny, for example, is evolving with the times and in many urban areas is metamorphosing into a culture of 'outside wives', a culture which erodes the security provided to women and their offspring and may ultimately promote multiple partnerships [56].

The socioeconomic model approach

A third approach to explaining the spread of HIV is to look at the socioeconomic conditions that shape behaviour and risk situations. Many studies see sexual behaviour as a function not of changing or unchanging cultural traditions but of economic pressure [63–65]. In many developing countries, poverty and under-employment, particularly in rural areas, increase migration to cities, destroy traditional households and dilute social control. People with limited access to resources may be more likely to delay marriage, or form short-term relationships with people who can help support them. In some cases, poverty or lack of economically viable alternatives is believed to push women into commercial sex [66].

Several researchers have tried to draw links, based on worldwide statistical analyses, between HIV infection levels and broad indicators of socioeconomic development, including economic inequity, gender inequalities and human rights. These studies attempt, with limited success, to identify thresholds of wealth or social equity below which HIV may thrive but above which its spread is limited [67].

Some sociodemographic characteristics were shown to be associated with an increase in high-risk behaviour

across a number of cultures in sub-Saharan Africa [68,69]. Population surveys show that young people who live in towns, have blue-collar jobs, or are divorced, separated or widowed are more likely to have a high turnover of partners than their married, rural or white-collar peers. In multivariate analysis, educational attainment during adolescence was positively associated among adult men with increased non-marital sex in the last 12 months (Fig. 2). Among women, there are less clear patterns emerging [46]. The reason for this link may reflect a delayed age at marriage, the higher incomes of the better educated, the influence of schooling on new norms or attitudes, and the social mobility and also the physical mobility associated with being away from parents and other traditional sources of social pressures. Respondents with higher education may also be more willing to disclose their sexual behaviour. However, higher income and higher education have also been associated with higher condom use in non-marital partnerships [70-72].

Non-cohabitation between spouses, resulting most of the time from socioeconomic reasons especially in young couples, is very common in Africa (Table 3) [46]. Studies also showed that married men who live apart from their wives are far more likely to have casual partners than men who live with their wives [46,47]. The strength of the socioeconomic approach is probably best illustrated in the case of migration and HIV risk [73-76]. Some mobile people, such as truck drivers, are only at higher risk of contracting and passing on HIV because their work takes them from one place to another. Refugees who are displaced as a result of civil war have frequently been deprived of their livelihoods, which make them extremely vulnerable to economic pressures. Most of the circulatory movements are linked with the search for seasonal work, or the search for better economic opportunities than the current environment can provide. Seasonal work on commercial farms or in mines frequently leads to high concentrations of male workers who are separated from their families. They provide a ready market for sex workers, who may themselves also be motivated by the desire for independence from the pressures of the extended family. Migrant workers may often also carry HIV/STD infection back to their home communities.

Researchers in southern Africa point out that patterns of marriage and sexual relations have been fundamentally affected by generations of economic migration, which has become the norm for up to 60% of the male adult population of countries such as Botswana and Lesotho [77-80]. Long periods of separation have increased the number of casual partners, not just for migrant men but for the women they leave behind. Children are brought up from infancy by multiple parents and have to move frequently between the extended family resulting in a lack of parental control. Late marriage, increased marital disruption and frequent extra-marital sexual relationships

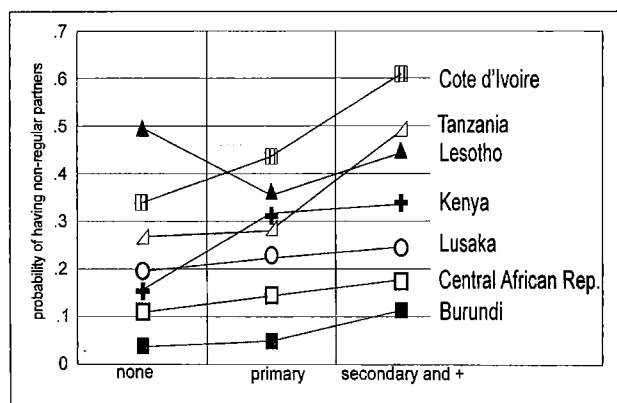


Fig. 2. Probability of having non-regular partners in the last 12 months by men's educational level. Lines do not represent mathematical function of linearity. Adapted with permission from [68].

Table 3. Percentage of all married men and women aged 15-49 years who were not cohabiting with principal spouse and who reported more than one regular partner/spouse.

	Men		Women	
	Not cohabiting	>1 Regular partner	Not cohabiting	>1 Regular partner
Côte d'Ivoire	43	36.3	36	NA
Kenya	20	12.7	20	NA
Lesotho	31	55.3	24	39.3
Tanzania	11	18.2	15	9.0
Lusaka	31	21.5	26	11.3

NA, not available.

can be seen as a series of interrelated changes that are historically linked to labour migration.

In west Africa, the drift of young, single men to cities in search of jobs has reinforced polygyny as young women become secondary wives to the older men who dominate resources in rural areas. Since young men in rural areas neither have wives nor the means to pay bride-prices for them, they become even more likely to migrate to cities [81]. The consequent pool of single, young men in urban areas acts as a magnet for those women who may have no assets but their bodies and who make a living by selling sex. However, several studies have noted that poverty is rarely the only driving force for women who work as prostitutes; history, social values such as competition for social rank and status and gender-driven exploitation within and outside marriage are also important factors contributing to prostitution [82-84].

Discussion

The focus of this review was on the determinants of HIV epidemics, in particular HIV epidemics in sub-Saharan

Africa. The three different approaches that have been described each present important dimensions of the realities that drive or prevent the spread of HIV through a community. They go beyond the psychosocial models, not addressed here, that try to explain motivations and reasons for behaviour at an individual level. Instead, they focus on the influences that shape the behaviour of populations.

The epidemiological model often limits itself to the identification and analysis of risk factors for HIV infection at the individual level. Comparisons of prevalence levels of risk factors between different populations is required to unravel the dynamics of the propagation of HIV at the population level. In most epidemiological studies, the societal dimension of sexual interactions is highlighted in a series of discrete variables. While the model may look at social and demographic characteristics associated with risk behaviour, it cannot explore the nature of the relationship between different variables, and therefore does little to explain the factors which may make a person or a population vulnerable to HIV infection independently of individual behaviour. Cultural and socioeconomic approaches both investigate the landscape in which sex takes place and the norms and forces which shape people's choices and behaviours. The first approach tends to present 'culture' as something monolithic and unchanging and not amenable to change, and quite often appears problematic when related to history and to political economy. The second approach is more likely to assume that people's behaviour is dictated by a rational response to economic circumstances and glosses over behaviours which are rooted in religion and other belief systems. The weakness they have in common is that they frequently ignore the political determinants governing many areas of people's lives.

None of these approaches alone is comprehensive enough to fully explain the complexity of the HIV epidemic, or indeed of human sexual behaviour; as yet there has been no successful attempt to integrate all four approaches (taking into account the individual psychosocial theory) or other models [85,86] into a single theoretical framework which would explain the complex relationships between cultural and economic forces and the behaviours they influence.

This should not, however, be unduly discouraging. There is an increasing awareness at the programmatic level that personal behaviour is critically influenced and conditioned by the societal context [87,88]. Indeed, epidemiological, cultural and economic studies each serve to illuminate a different part or level of the whole picture, and should shed enough light to suggest appropriate interventions in specific contexts. In the context of commercial sex, for example, an epidemiological study may suggest interventions aimed at increasing condom use and efficacious treatment of STD. Anthropological studies

which reveal that high levels of polygyny create a demographic imbalance would point to community programmes targeted at promoting safe behaviour among young men, with an emphasis on migrants to cities. Economic analysis may identify a lack of income-generating opportunities for young women in rural areas as a major factor pushing them into prostitution, supporting interventions aimed at increasing their educational level or decentralizing investments in order to provide jobs in rural areas. In planning for development of industrialized projects, managers may favour household labour migration to avoid the concentration of single men and may try to reduce displacement of the local population.

The impact of intervention strategies at the community level is more difficult to predict because the link with sexual behaviour and HIV transmission is not direct. That is why the design of such programmes requires a careful assessment of the potential determinants of vulnerability to HIV. In urban areas of Uganda and Zambia, where the HIV epidemics have been the most severe, new unexpected behaviours have emerged among the youth, such as a long delay before first sexual intercourse [89]. Solely concentrating on reducing epidemiological risk factors cuts out potentially radical interventions with long-term effects; targeting cultural and socioeconomic determinants without a clear understanding of their links with epidemiological risk factors may also be misleading. In the absence of a framework that enables people to explain the complex web of factors which govern lives and behaviour, all existing approaches should be considered as having the potential to identify useful points for intervention against the spread of HIV [7]. Improving our understanding of the many factors which leave people vulnerable to HIV infection through such interventions may lead to an expanded repertoire of responses and should help to slow the spread of HIV infection in widely differing situations.

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