

Low and stable HIV infection rates in Senegal: natural course of the epidemic or evidence for success of prevention?

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Objectives: To document the level of HIV infection in Senegal and also to review evidence of the impact of efforts in prevention, developed by the National AIDS Control Programme and the Civil Society, on the level of the HIV epidemic.

Methods: Research, compilation and critical review of all relevant data on HIV and sexually transmission diseases (STDs) epidemiology, sexual behaviour, and the efforts in prevention developed in Senegal.

Results: From 1989 to 1996, the levels of HIV infection estimated in four sentinel urban regions remained stable at around 1.2% in the population of pregnant women, and at 3% in male STD patients. It had increased to 19% in female sex workers. A strong political and community commitment led to an early response to the HIV/AIDS epidemic that has been extended since 1986. Blood transfusion safety was established at the start of the HIV epidemic. The level of knowledge of preventive practices relating to HIV/AIDS among the general population exceeded 90% in the early 1990s. From 1991 to 1996, a 30% to 66% decrease of the STD prevalence rates was observed in pregnant women and sex workers in Dakar. In 1997, 33% of men aged 15–49 years in Dakar reported having had sex with non-regular partners. Among them 67% reported condom use.

Conclusions: It is not possible to know what the course of the HIV epidemic in Senegal would have taken in the absence of efforts at prevention. Certainly, several factors that pre-dated the occurrence of AIDS in Senegal laid the groundwork for a positive response. However, data from a number of sources do reveal the successfulness of efforts in prevention. From available data, Senegal can rightfully claim to have contained the spread of HIV by intervening early and comprehensively to increase knowledge and awareness of HIV/AIDS and to promote safe sexual behaviour.

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Introduction

The HIV epidemic began in sub-Saharan Africa, at the end of the 1970s and early 1980s [1]. Between 1976 and 1987, cross-sectional serological surveys conducted in many countries of West Africa showed an almost simultaneous emergence of the HIV epidemic [2,3]. In that region, less than one person per 1000 was infected with HIV before 1985. Ten years after those surveys, the seroprevalence of HIV infection had risen among pregnant women to 8% in the urban centres of Burkina Faso, 8.5% in the urban centres of Guinea Bissau, and 14% in Abidjan, in Côte d'Ivoire [4–6].

The first case of AIDS in Senegal was recorded in 1986. With strong political and community commitment, the National AIDS Prevention Committee (NAPC), which was set up in 1986, made an early and extensive response to the epidemic. This response included: (1) prevention of transmission through blood by means of systematic HIV screening of all bags of blood used for transfusion; (2) prevention of sexual transmission through awareness campaigns for responsible and safer sex; (3) widespread screening and treatment of sexually transmitted diseases (STDs); (4) promotion of condom use and provision of affordable, good quality condoms; (5) special interventions for groups at high risk of HIV infection, such as female sex workers (FSW). Concentrating on prevention at the outset of an HIV epidemic has been advocated as the most cost-effective way of controlling or even stopping it [7].

A series of cross-sectional serosurveys conducted since 1986 have consistently yielded estimates of HIV seroprevalence of around 1% among pregnant women attending antenatal clinics [8–10]. This low HIV prevalence in Senegal, which contrasts with the situation in a number of West African countries, raises many questions. Does the available epidemiological information really show low and stable HIV seroprevalence in the general population in Senegal? If so, does the natural course of the HIV epidemic in a highly specific Senegalese context explain the situation? Or does the low and stable rate of HIV infection indicate that the nation has successfully responded and averted the threat of a major epidemic?

To answer these questions, we examined available data on the epidemiology of HIV infection and STDs in Senegal, on the environmental context, and on the sexual behaviour of the population. We also reviewed the AIDS prevention and control activities that have been implemented since the emergence of the HIV/AIDS epidemic.

Methods

The study involved collection, compilation and critical review of existing data on HIV/AIDS in Senegal. The data examined came from HIV and STD sentinel surveillance systems, and from several behavioural studies in various population groups. Programme information was found in the reports of internal and external reviews of activities conducted by the NAPC.

Surveillance of HIV infection and STD

In 1989 the NAPC set up a national sentinel network to monitor HIV infection [8]. The sentinel posts were set up in four cities of Senegal: Dakar, Kaolack, Ziguinchor and Saint-Louis (Fig. 1). The vast majority (74%) of the urban population of Senegal lives in these cities. Sentinel surveillance concentrated on the populations of pregnant women, FSW and men consulting for signs or symptoms of STD; this research following WHO/Global Programme on AIDS (GPA) guidelines [11,12].

In addition an open cohort of FSW in the capital, Dakar, was monitored from 1985 onwards with the aim of evaluating candidate HIV vaccines if available [13]. Between 1985 and 1995, that cohort provided data on the incidence of HIV infection in the population of registered FSW.

Diagnosis of HIV infection for all those sentinel posts was conducted in the Bacteriology and Virology Laboratory of the Aristide Le Dantec Hospital, which is the national reference laboratory for HIV infection in Senegal. All the sera were evaluated using a mixed ELISA test (Genelavia, Mixt, Sanofi Diagnostics Pasteur, Paris, France). All sera reacting to this first screening were examined with Western Blot (New Lav Blot I and New Lav Blot II, Sanofi Diagnostics Pasteur, Paris, France) for confirmation and type-specific diagnosis of HIV [14].

The prevalence of other STDs among random samples of pregnant women and FSW was measured in Dakar

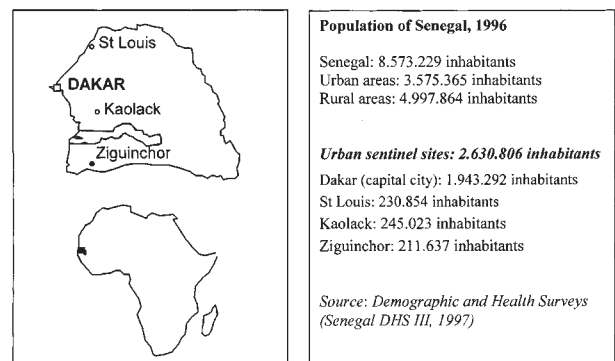


Fig. 1. Map of Senegal (West Africa) indicating HIV sentinel surveillance sites.

in 1991 and 1996 [15]. Systematic screening using microbiological diagnosis [16] was employed for the following STDs: *Treponema pallidum*, *Neisseria gonorrhoeae*, *Chlamydia trachomatis* and *Trichomonas vaginalis*. The same diagnostic method in the same laboratory was used in 1991 and 1996.

Collection of behavioural data

Anthropological studies conducted on the social patterns of sexuality in the last 10 years in urban and rural Senegal were reviewed [17]. In addition, a number of studies of knowledge, attitudes, beliefs and practices in HIV/AIDS were carried out between 1989 and 1996 in various populations groups following standard methods [18,19].

In 1997 a random sample of 800 men and 800 women aged 15 to 49 and representative of the urban population of Dakar was selected and interviewed in order to obtain information on demographic characteristics (age at first sexual intercourse, age at first marriage), on sexual behaviour (number of sexual partners, type of partner), use of condoms and symptoms of STDs [20]. The general methodology applied conformed to the standardized protocol recommended by WHO/Global Programme on AIDS and the United Nations Programme on HIV/AIDS for population surveys [21].

A cross-sectional survey was also used in 1997 to collect behavioural data from several specific groups including school pupils, students, company employees and FSW in the urban centres where sentinel serological surveillance was taking place [22].

Examination of the activities of the National AIDS Control Programme

As in many African countries, the NAPC in Senegal applied the strategy recommended by WHO/GPA for

limiting the spread of the HIV/AIDS epidemic [23]. A summary of internal and external independent reviews of the NAPC from its establishment until 1997 was analysed [18]. The report showed which of the prevention and control activities were widespread enough to influence risk behaviours and/or the prevalence of HIV and STD. Finally, the records of condom wholesale distributors in the public sector were consulted to find out the number of condoms distributed throughout the country between 1988 and 1997.

Data analysis

The data from surveillance of STD, HIV infection and sexual behaviour were analysed with the Epi-Info programme (WHO, Geneva, Switzerland). The χ^2 test was used to test for a difference between proportions from one year to the next, in different sites and in different groups. Trend analysis to compare levels of prevalence of HIV infection from 1989 to 1997 was used following the method described by Fleiss [24].

Results

Prevalence of HIV infection and other STDs

Table 1 shows the level of HIV infection in urban sentinel sites in Senegal between 1989 and 1996. Over the period, HIV seroprevalence values ranged between 0.1% and 1.6% in pregnant women, between 0.4% and 3.6% in men with STDs and between 6% and 35.9% among FSW. HIV seroprevalence rates differed significantly from one population group to the next and from one city to another. The prevalence of HIV infection remained low among pregnant women and rose slightly among men with STD. HIV infection was, however, significantly higher among FSW. From the north of the country (Saint Louis) to the south (Ziguinchor), data

Table 1. HIV infection rates in four sentinel urban regions in Senegal^a.

Sentinel sites	Pregnant women			STD male patients			Female sex workers		
	n	%	95% CI ^b	n	%	95% CI ^b	n	%	95% CI ^b
Saint-Louis	1384	0.1	0.0–0.5	234	0.4	0.0–2.4	283	6.0	3.5–9.4
1989–1990	706	0.1	0.0–0.8	151	0.7	0.0–3.6	134	8.2	4.2–14.2
1991–1992	678	0.2	0.0–0.8	83	0.0	0.0–4.3	149	4.0	1.5–8.5
Dakar	2312	0.7	0.4–1.1	2181	3.6	2.8–4.4	4615	13.9	12.9–14.9
1989–1990	343	1.2	0.3–2.9	543	2.4	1.3–4.1	692	9.8	7.7–12.3
1991–1992	763	0.6	0.2–1.5	670	3.6	2.3–5.3	1608	11.0	9.5–12.6
1993–1994	527	0.8	0.2–1.9	470	4.9	3.1–7.3	529	16.6	13.6–20.1
1995–1996	679	0.7	0.2–1.7	498	3.6	2.1–5.6	1786	17.3	15.6–19.1
Kaolack	3005	1.1	0.8–1.6	340	2.3	1.0–4.6	863	35.9	32.7–39.2
1989–1990	682	1.6	0.8–2.9	189	3.7	1.5–7.5	179	29.6	23.0–36.9
1991–1992	318	1.6	0.5–3.6	69	4.3	0.9–12.2	309	39.2	33.7–44.8
1993–1994	486	2.9	1.6–4.8	33	3.0	0.1–15.8	169	37.3	29.9–45.0
1995–1996	1519	0.3	0.1–0.7	49	2.0	0.1–10.8	206	35.4	28.9–42.4
Ziguinchor	5316	1.6	1.3–2.0	939	2.0	1.2–3.1	1140	30.6	27.9–33.4
1989–1990	915	2.1	1.3–3.2	366	1.4	0.4–3.2	267	21.3	16.6–26.8
1991–1992	1705	1.2	0.8–1.9	366	1.9	0.8–3.9	293	26.9	21.9–32.4
1993–1994	1417	1.5	0.9–2.3	136	2.9	0.8–7.4	257	43.2	37.0–49.5
1995–1996	1279	1.9	1.2–2.8	71	4.2	0.9–11.8	323	34.7	29.5–40.1

^aData are for both HIV-1 and HIV-2. ^b95% Confidence Interval (CI).

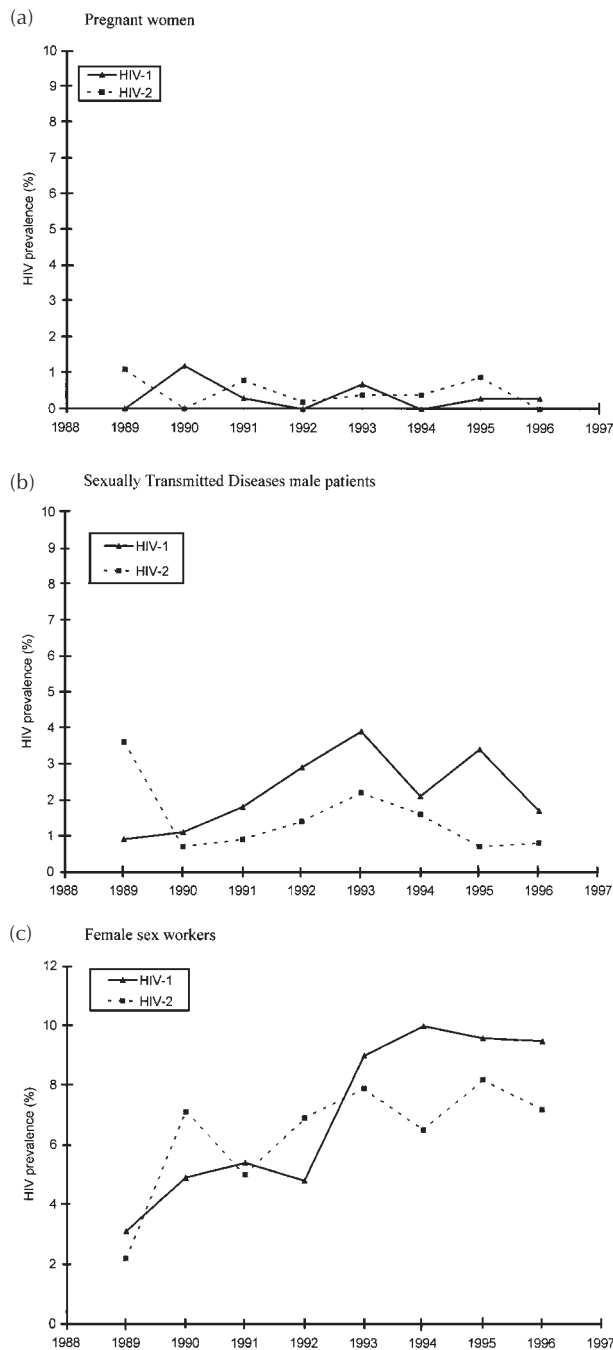


Fig. 2. Trends of HIV infection rates among (a) pregnant women, (b) sexually transmitted diseases male patients, and (c) female sex workers in Dakar (Senegal), as shown by sentinel surveillance.

showed a statistically significant pattern ($P < 0.001$) of greater HIV prevalence among FSW. Fig. 2 shows the trends in HIV infection observed between 1989 and 1996 among pregnant women, STD patients and FSW in Dakar. Trend analysis showed no significant increase in the HIV epidemic between 1989 and 1996 among pregnant women ($P = 0.37$) or among men with STD ($P = 0.29$). Among FSW, the prevalence of HIV infec-

tion tended to rise ($P < 0.001$). However it seemed to plateau around the level of 17% between 1993 and 1997 ($P = 0.99$). Whereas both HIV-1 and HIV-2 infections are present in all three population groups, there is no obvious difference in infection levels between the two strains and both follow roughly the same trends over time (Fig. 2). Table 2 shows the rates of HIV infection among pregnant women by age group. There is almost no new HIV infection among pregnant women between the ages of 15 and 24 in Dakar. In a cohort of 997 registered FSW in Dakar, the incidence of HIV-1 and HIV-2 infection overall was 1.1 per 100 person-years between 1985 and 1995. There was no evidence for an increase ($P = 0.07$) in the incidence of HIV infection (data not shown).

In a random sample of 663 sexually active men in 1997, 14 (2.1%) reported at least one episode of STD in the past 12 months. Table 3 shows the frequency of STD observed at the Institute of Social Hygiene in Dakar where pregnant women have access to antenatal care and sex workers to STD screening and treatment services. Between 1991 and 1996, the prevalence of STD among pregnant women and sex workers fell dramatically (Table 3).

Demographic and sexual behaviour data

Senegal is 93% Muslim and 5% Christian. Male circumcision is universal from the age of seven. In a population-based survey in Dakar, fewer than 5% of the population reported drinking alcohol in the last month. Prostitution was legalised in 1969; and since then regular screening and treatment for STDs have been offered to FSW in the cities where they are concentrated. The number of non-registered FSW is not known but is estimated to be as large as the number of registered FSW.

A population-based survey in Dakar in 1997 showed that the median age at first sexual intercourse was 18 years for both women and men. The median age at first marriage was 19 for women and 28 for men, a later age associated with high levels of polygyny. Thirty-two percent of women and 91% of men reported premarital sex. Table 4 shows the percentage distribution of reported sexual relations with casual partners among sexually active people in Dakar. Forty-three percent of men and 10% of women 15–24 years old reported sex with a casual partner in the last 12 months. Overall, in men and women, the proportion with two or more casual partners was low, at 8.3% and 2%, respectively. Twenty-four out of 663 men (3.6%) and eight out of 629 women (1.3%) reported having sex in exchange for money in the last 12 months.

Availability and use of condoms

Condoms have become far more widely available in the last 10 years. Distribution multiplied by a factor of

Table 2. HIV infection rates among pregnant women in Dakar (Senegal), by age group^a.

	≤ 19 years		20–24 years		25–29 years		≥ 30 years	
	%	(HIV+/Total)	%	(HIV+/Total)	%	(HIV+/Total)	%	(HIV+/Total)
1989	0.0	(0/40)	2.4	(1/42)	0.0	(0/41)	4.0	(2/50)
1990	0.0	(0/24)	1.7	(1/58)	2.8	(1/35)	0.0	(0/53)
1991	0.0	(0/76)	0.9	(1/105)	2.5	(2/81)	0.9	(1/110)
1992	0.0	(0/49)	0.0	(0/111)	0.0	(0/92)	0.7	(1/139)
1993	2.7	(1/37)	1.3	(1/78)	1.7	(1/58)	0.0	(0/85)
1994	0.0	(0/39)	0.0	(0/80)	1.7	(1/58)	0.0	(0/76)
1995	1.8	(1/54)	0.0	(0/95)	1.4	(1/70)	2.4	(2/83)
1996	0.0	(0/73)	0.0	(0/108)	1.0	(1/95)	0.0	(0/101)

^aData are for both HIV-1 and HIV-2. HIV+, HIV positive.

Table 3. Comparison of STDs rates in pregnant women and female sex workers between the 1991 and 1996 clinic-based surveys, Dakar, Senegal.

	Year of examination		
	1991	1996	P-value
Pregnant women	n = 511	n = 540	
<i>Trichomonas vaginalis</i>	30.1	18.1	< 0.001
<i>Chlamydia trachomatis</i>	11.9	6.7	< 0.01
<i>Neisseria gonorrhoeae</i>	2.0	0.9	0.21
Syphilis	7.5	4.4	0.04
Female sex workers	n = 374	n = 973	
<i>Trichomonas vaginalis</i>	46.0	15.4	< 0.001
<i>Chlamydia trachomatis</i>	12.6	7.5	< 0.01
<i>Neisseria gonorrhoeae</i>	17.4	4.7	< 0.001
Syphilis	29.5	20.0	< 0.001

10 between 1988 and 1997, going from 800,000 to 7 million, for a population of 9 million in 1997. In the same year, over 85% of the adult population was estimated to have easy access to condoms in urban areas and 99% of FSW reported easy access to condoms. Among those who reported having had casual sex in Dakar in the last 12 months, 67% of men and 45% of women reported using a condom in their last sexual intercourse with a casual partner. Of the 738 FSW interviewed in 1997 in the four largest cities in Senegal (Dakar, Saint-Louis, Kaolack and Ziguinchor), 94% said they had used a condom the last time they had sex with a regular client and 98% with a new client.

Public response to the HIV/AIDS epidemic

In terms of the organisation of health and health information services, three factors seem to have provided a good grounding for an effective response to the

HIV/AIDS epidemic in Senegal when it emerged in 1986. The first was the existing STD screening and treatment system for registered FSW, which had been running since 1969. The second was the national STD control programme, in place in most health facilities. In Africa, Senegal was a pioneer in the development of a national STD control. The programme started in 1988 offering STD care in venereal diseases clinics. It has since evolved, and the management of STDs is now widely integrated into regular primary health care services. Care providers have been trained, and a system of cost recovery for STD drugs is in place to ensure sustainability. The drop in the prevalence of STD among pregnant women and sex workers in Dakar between 1991 and 1996 (Table 3) is testimony to the success of the programme. The third factor was the large number of non-governmental organisations (NGOs) which had already developed a tradition of commitment to health through the promotion of vaccination and control of malaria.

There were four special features of the Senegalese response to the HIV epidemic. The first was the early establishment of a transfusion policy centred on the prevention of transmission of HIV through blood. Compulsory screening of every batch of blood for HIV infection was set up in 1987 in all 10 regions of Senegal. The second feature was the use of existing STD screening and treatment services as entry points for information, counselling, condom provision and promotion of safe behaviour, especially among sex workers. The third feature was the extent of social mobilization in the development of campaigns of

Table 4. Percentage distribution of male and female respondents according to the number of casual sexual partners (among all persons who have been sexually active in previous 12 months), Dakar, Senegal, 1997.

	Number of casual partners				Total	
	0	1	2–4	≥ 5	n	%
Men						
15–24 years	57.4	33.2	8.9	0.5	202	100
25–49 years	70.5	21.7	7.2	0.6	461	100
15–49 years	66.5	25.2	7.7	0.6	663	100
Women						
15–24 years	85.2	14.8	0.0	0.0	142	100
25–49 years	91.6	5.9	2.5	0.0	487	100
15–49 years	90.1	7.9	2.0	0.0	629	100

information, education and communication (IEC) activities to promote responsible and safe sexual behaviour and to encourage the use of condoms. The existing network of hundreds of NGOs served as the basis for this mobilization. Local communication to effect a change in behaviour was essential: at the workplace, in schools and universities, stations, roads, markets, kiosks, touring cinema buses in peripheral regions, national days of action, etc. Tens of thousands of IEC items (brochures, handbooks, videos, posters, etc.) were produced by the NAPC and NGOs. By 1992, the Ministry of Education had included sex education with an HIV component in the school curriculum for children aged 12 and over. Teachers were trained and educational brochures were included in the curriculum. In the course of 1997, over 130,000 school manuals devoted to IEC on HIV/AIDS were distributed in public and private teaching establishments. IEC activities covered the whole of the country thanks to the media and regional and departmental AIDS control committees. The fourth feature was the concerted and effective effort to include religious and community leaders and politicians at all levels in AIDS prevention activities. Widely-publicised national conferences were held by both Moslem and Christian leaders; they lent considerable moral support to the provision of universal information about AIDS and other STDs, as well as to efforts to promote responsible sexual behaviour.

In addition, Senegal also benefited from major technical and financial contributions from its international partners in AIDS control. Technical agencies or donors (WHO, the European Union, the United States Agency for International Development, Coopération Française, etc.) regularly conducted reviews of the national programme. These independent evaluations helped to readjust the focus of prevention and control activities on a regular basis.

Discussion

A great deal of epidemiological, sociobehavioural and programme information on controlling the spread of the HIV/AIDS epidemic has been collected in Senegal. This information strongly suggests that HIV prevalence is low and stable in the country. It also shows that, although casual sex is relatively common in urban areas, condoms are used in most potentially risky relationships. The information also suggests that the speed, appropriateness and extent of efforts to prevent and control the HIV/AIDS epidemic in Senegal helped to stabilize the progression of HIV in the population at large.

Overall prevalence of HIV infection among pregnant women has fluctuated around 1%. In the 8 years of

monitoring, no significant increase in the prevalence of HIV infection has been found at any of four sentinel sites that cover major urban centres in Senegal. Estimates of the prevalence of HIV infection among pregnant women can be inaccurate if there is a significant difference between the women recruited by the surveillance system and those of the general population in terms of age, fertility, contraceptive use, migration, mortality, sexual behaviour and recourse to health services [25]. In-depth analysis of the situation in Senegal and of the surveillance protocol system does not suggest major differences between antenatal clinic attenders and other women, in terms of the factors listed above. Considering the procedures used, it is unlikely that the strategy for HIV diagnosis used in Senegal was consistently less sensitive than other procedures, or that any major participation bias could have distorted the stable HIV trend observed.

In other population groups and in other settings, the prevalence of HIV infection is equally low and stable. Among blood donors in Dakar, the prevalence of HIV infection measured between 1987 and 1993 has never exceeded 0.6% [26]. In rural areas, in community-based surveys, HIV prevalence below 1% was also found among pregnant women and other adults [9,27].

However, stable HIV seroprevalence in a population can conceal large numbers of new infections in a particular subgroup, such as the youth subgroup [25]. Data among pregnant women aged 15–24 in Dakar has shown that there is almost no new HIV infection over time, suggesting that the HIV epidemic is stable. The stable low incidence of HIV infection among a cohort of sex workers in Dakar also indicates a similar trend [13].

In West Africa, cross-sectional serological surveys conducted between 1976 and 1986 revealed an almost simultaneous emergence of the HIV epidemic in several countries [2,3]. Why is there a low and stable HIV seroprevalence in the general population in Senegal whereas in some other countries of West Africa the epidemic is far more severe? The specific HIV epidemic in Senegal may be attributable to intrinsic factors, i.e., the characteristics of HIV (transmissibility, pathogenicity and virulence) and of the host (age, sex, sexual behaviour, etc.) and/or to the social and environmental context.

There is no evidence to support the hypothesis that the HIV circulating in Senegal is less communicable than that elsewhere in Africa or that the Senegalese have some natural immunity to HIV infection. At the start of the epidemic in Senegal there was a higher proportion of HIV-2 in the country, which is known to be less transmissible [8,28]. But by the end of the 1980s and the early 1990s, HIV-1 and HIV-2 were found in similar proportions in the country [8]. The example of

Guinea-Bissau, a neighbouring country, shows that certain factors can lead to a major epidemic of HIV-2 comparable to that occurring with HIV-1 [29]. Furthermore, whereas in Senegal it was suggested that HIV-2 could protect against infection with HIV-1, it seems clear that such protection, if any, would be only conferred on people already infected with HIV-2 and not on uninfected people exposed to both HIV-1 and HIV-2 [30].

There are factors, found throughout Senegal, which are known to be associated with less vulnerability to HIV infection: male circumcision, and low consumption of alcohol. The association between consumption of alcoholic drinks and exposure to the risk of HIV infection has not yet been clearly established but high consumption is known to affect condom use [31]. Male circumcision seems to reduce the risk of HIV infection by a factor of between 2 to 8 [32]. Another factor is the legalization of prostitution. This brought the FSW out of hiding, allowing those registered to be protected with such initiatives as conventional STD control and condom use long before the emergence of the AIDS epidemic. The experience of Senegal suggests that the effectiveness of sex worker registration in controlling STDs and HIV depends upon the quality of the services offered. Clearly, if registration is used as means of repression rather than as an entry point for the provision of health information and services, it less likely to be effective as a public health measure.

Relative social cohesion around strong religious values has also been found. It is believed that these moral values make for considerable social control of sexuality in general and female sexuality in particular. Indeed, sufficient information in Africa is available to show that social disintegration caused by cultural changes, social movements, conflict, famine and economic migration has made a real contribution to the HIV outbreak in certain regions [33]. Data on behaviour collected in Dakar in 1997 showed a low average reported number of casual sexual partners but a high proportion of men reporting casual sex in the previous year. Has the severe religious disapproval of casual sex led to under-reporting of such practices in Senegal? Lagarde *et al.* in their study in rural areas of Senegal found no evidence of systematic under-reporting of sexual practices [34]. In other West African countries with different religious and profiles such as Côte d'Ivoire and Guinea Bissau, where the HIV epidemic is more severe, the proportion of multiple sexual relations reported by men (≥ 2 casual partners in the previous year) was three to four times higher than that found in Dakar in 1997 and the age at first sexual intercourse was reported to be much lower [35].

Early and sustained commitment from political, religious and community leaders and the media to

AIDS control has led to massive community mobilization beyond the NAPC's own efforts. Safety of blood transfusion was established at the start of the HIV epidemic in all regions of Senegal. Early on, behavioural studies in Senegal showed a high general level ($> 90\%$) of knowledge of how to prevent HIV/AIDS both in the general population and in specific groups (FSW, factory workers, school pupils, students, etc.) [18]. In rural areas, where it was possible to conduct repeated surveys, it was clearly shown that knowledge of AIDS improved and risk behaviour declined considerably over time [27].

Increased condom use in sexual relations as reported in Senegal has to be linked to the achievement of a broad consensus in the society about promotion, access and use of condoms obtained by the active participation of governments and religious institutions in AIDS control activities. In Uganda, similar levels of condom use had led to a sharp decline in new infections among the population's youth [36].

Social control of sexuality by tradition and religion, generalized male circumcision, legalization of prostitution, and the national STD control programme which was started before AIDS appeared, have most probably set the groundwork for reduced vulnerability of the population to HIV infection. But it seems plausible that, on their own, these factors would not have been enough to stabilize the HIV epidemic in Senegal at such a low level. Schooling, urban development and modernization, and economic migration, all of which are increasing in Senegal as elsewhere in Africa, shake the moral foundations of the sexual practice established by tradition and religion. We know from experience that religious morality attaches value to behaviour such as sexual abstinence prior to marriage and mutual fidelity within the monogamous or polygamous union. The indicators examined suggest that premarital sex has become the norm among young people in Senegalese cities, and casual sex is relatively common among men in urban areas. Among migrant workers, HIV infection rates are clearly higher than in the general population [37,38]. In all these situations, it is likely that AIDS prevention interventions, including STD control and condom promotion, have had a considerable effect in limiting the general population's exposure to HIV.

There are many failures of AIDS control in Africa that attract attention. Modesty or even excessive prudence greatly limits the spread of success stories. AIDS control workers need such information to bolster their determination to control the HIV epidemic. Donors need such information to measure the extent to which their support benefits countries. The example of AIDS control in Senegal gives rise to a degree of hope and may justify resources invested in prevention, especially in early stages of the HIV epidemic. Thailand, Uganda

and Jamaica give us also strong evidence that expanded programmes to raise HIV risk awareness and promote condom use in commercial, premarital and extramarital sexual activities can curb the course of an HIV epidemic significantly [36,39,40].

There are, of course, a number of gaps in the scientific evidence about this success in Senegal. Certainly, epidemiological monitoring must be strengthened, and expanded among other vulnerable groups such as migrants and non-registered sex workers. Surveys to monitor sexual behaviour in the population should be repeated at regular intervals, especially those on young people. It must be recognised, however, that it will never be possible to be absolutely sure of the contribution of the massive national-level efforts in prevention seen in Senegal. Since the country intervened early and comprehensively, there is no population that did not benefit from efforts in prevention which might serve as a control group for comparison. It is therefore not possible to know what the course of the epidemic would have been in the absence of this preventative response. This is a central difficulty in evaluating the success of an early prevention programme for HIV or any other emerging disease.

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