Original Article

High sexual risk taking and diverging trends of HIV-1 and HIV-2 in the military of Guinea Bissau

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Abstract

Background: HIV and other sexually transmitted infections are a growing problem in the military personnel of Africa, and information about this problem in Guinea-Bissau is lacking. The aims of this study were to determine the prevalence and trends of the HIV epidemics in the military forces of Guinea Bissau and to explore possible risk factors for HIV infection.

Methodology: Repeated cross-sectional surveys of HIV-1 and HIV-2 were conducted between 1992 and 2005, and knowledge, sexual behaviour and risk factors for HIV-1 and HIV-2 in military personnel in Guinea-Bissau were assessed.

Results: The seroprevalence of HIV-1, HIV-2 and HIV-1+HIV-2 dual reactivity was 1.1%, 8.4% and 0.1% in 1992-95, and in 2005 7.7%, 5.1% and 1.9%, respectively. Both the increase of HIV-1 and the decline of HIV-2 between 1992-95 and 2005 were significant when adjusted for age ($p < 0.001$ for both changes). Only a minority did not know how HIV transmits, but sexual risk taking was high. Several significant risk factors were found in univariate analyses for HIV-1 and HIV-2, but the only risk factor that remained significant after multivariate regression analysis was previous contact with a prostitute among HIV-1-positive subjects (single and dually reactive) ($p < 0.01$).

Conclusion: The increasing trend of HIV-1 and the high risky sexual behavior illustrate the need for improvement in HIV/AIDS prevention efforts among military personnel in Guinea Bissau.

Key words: HIV-1, HIV-2, STI, military, Africa, Guinea-Bissau

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Introduction

Military personnel in Africa are at high risk of contracting and transmitting sexually infections (STIs), including HIV/AIDS. The impact of HIV on the military in the African continent has assumed alarming dimensions. It is estimated that sexually transmitted disease rates among armed forces are generally two to five times higher than in the civilian populations [1], and prevalence rates of HIV between 5.8% and 26.7% have been reported from different African militaries [2]. AIDS is now the leading cause of death in military and police forces in some African countries, accounting for more than half of in-service mortality [3].

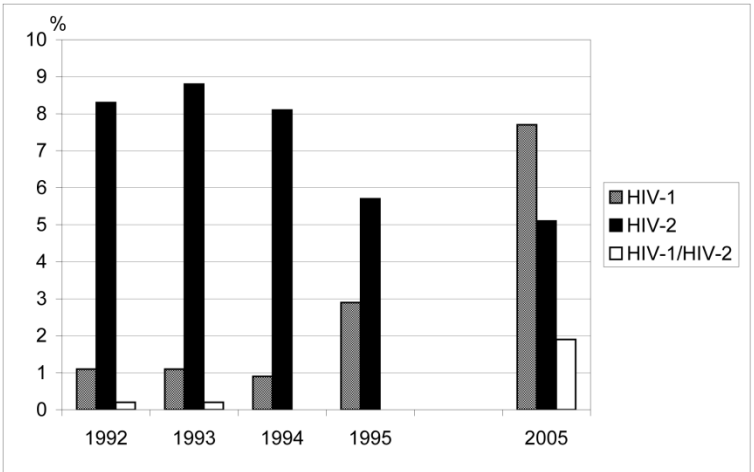
Guinea-Bissau has the highest prevalence of HIV-2 in the world, but over the last years declining prevalence rates have been observed, both among pregnant women and in two population-based studies from urban and rural Guinea-Bissau [4-6]. Concurrently, the prevalence of HIV-1 has increased significantly in the same study groups.

The objectives of this study were to determine the prevalence and trends of the HIV epidemics in the military forces of Guinea Bissau during the period 1992-2005. We also wanted to explore possible risk factors for HIV infection.

Materials and methods

The study was conducted in seven main military bases in the seven main cities of Guinea Bissau (Bafatá, Bissau, Canchungo, Cumeré, Gabu, Mansoa, and Quebo). Four cross-sectional studies were performed at yearly intervals during the period 1992-1995 and a total of 1,592 subjects (0.9% women)

Figure 1. Seroprevalence (%) of HIV in military personnel in Guinea-Bissau 1992-2005. Total number of subjects in 1992, 1993, 1994, 1995 and 2005 was 636, 465, 456, 35 and 725, respectively)



were included. In every survey, all military officers and recruits from each one of the bases were invited to participate. In 2005, a new serosurvey was organized in five of these cities and in three additional cities (Nhala, Bambadinca and Buba). Similarly, all military personnel were invited to the study, and 725 subjects (1.5% women) were included.

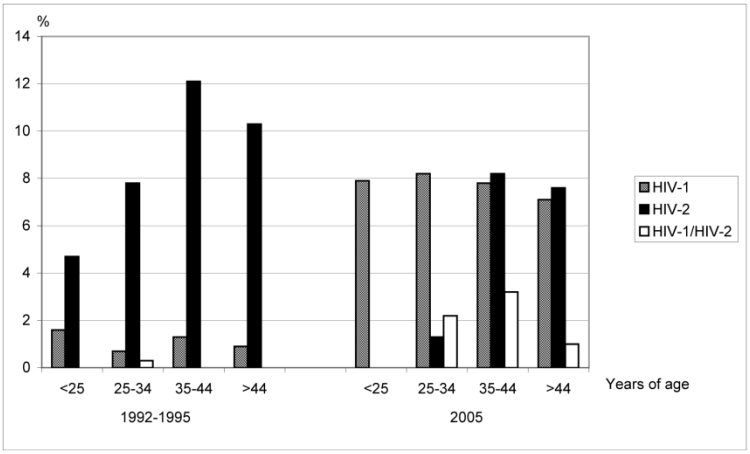
At inclusion, after informed consent was given, a physical examination was done, a questionnaire was performed, information about STI and HIV/AIDS was given, and a blood sample was drawn for serologic testing of HIV and syphilis. The questionnaire included data on age, gender, education, HIV/AIDS knowledge and sexual behavior, such as condom use, involvement in commercial sex, and number of sexual partners outside of marriage in the last month. Information on the individual's history of blood transfusion, circumcision, genital ulcer, and urethral discharge was also gathered. Unfortunately the questions regarding knowledge of HIV/AIDS and previous contact with a commercial sex worker was not included in the questionnaire until 1994 (most of the 1994 survey and then onwards), and by mistake the question of circumcision was not included in the questionnaire of 2005 so only parts of the total number of persons were analyzed regarding these questions. Free condoms were distributed and medical treatment was given for current diseases. Positive results of syphilis serology were individually linked and adequate treatment given. In case of individual requirement, HIV results were given and individual counseling was offered. No antiretroviral treatment was available in the country when the study was done.

The serum samples were tested for HIV-1 and HIV-2 antibodies at the National Laboratory of Public Health (LNSP) in Bissau using the Behring Enzygnost HIV-1+2 ELISA (1992-1994) or Enzygnost HIV-1+2 Plus ELISA (1995) (Behring, Marburg, Germany). The samples were then confirmed by Western Blot (WB). Sera dually reactive on HIV-1 and HIV-2 WB assays were further tested with a synthetic peptide ELISA for discrimination between HIV-1 and HIV-2 (Peptilav, Sanofi Diagnostic Pasteur, France). For the 2005 samples, an alternative confirmation strategy was used with Capillus HIV-1/HIV-2 (Cambridge Biotech Limited, Galway, Ireland) and Immunocomb II HIV-1 and 2 BiSpot RST (Orgenics, Yavne, Israel) [7]. Sera were also screened for *Treponema pallidum* antibodies with a hemagglutination test (TPHA, Fujirebio, Japan).

Statistical analysis

Odds ratios (OR) with 95% confidence interval (CI), p-values of Chi-square, Fisher's exact test and one-way analysis of variance (ANOVA) were calculated with Epi Info (Centers for Disease Control, U.S.A. and WHO, Switzerland). Multivariate logistic regression analyses were performed using STATA (Stata Corp. Texas, U.S.A.). In the regression analyses age was treated as a continuous variable.

Figure 2. Seroprevalence (%) of HIV according to age distribution in military personnel in Guinea-Bissau 1992-2005. Mean age was 31.3 and 38.2 years in 1992-95 and 2005, respectively. Total number of subjects in the different age groups in the period 1992-1995 was 385, 688, 389 and 117, and in 2005 63, 232, 219 and 210.



Ethical considerations

The study was conducted in compliance with the Helsinki Declaration, and approved by the Research Ethics Committee at the Karolinska Institute, Stockholm, and the Ministries of Health and Defense and Military Leadership of the Republic of Guinea Bissau. Meetings with the Health Military Leadership and the Military Leadership Services were held. The information about the study and the invitations for the study were sent to all military bases by the Military Leadership through the Health Military Leadership Services. Pre-test counseling before the HIV test was done for each of the participants. Blood tests results were strictly confidential.

Results

In total, 2,317 subjects were included (1.2 % women), 1,592 in 1992-1995 and 725 in 2005. The overall prevalence of HIV-1, HIV-2 and HIV-1+2 was 3.2%, 7.3% and 0.7%, respectively. However, we observed significant changes of HIV-1 and HIV-2 between 1992-1995 and 2005 (Figure 1). Overall, 152 subjects (9.5%) were seropositive for HIV in 1992-1995; of them 17 (1.1 %) were HIV-1, 133 (8.4 %) HIV-2, and two subjects (0.1%) were HIV-1+HIV-2 dually reactive. All infected subjects were males. Similar prevalence rates were observed between 1992 and 1995. In 2005, 107 subjects (14,7%) were seropositive for HIV; of them 56 (7.7%) were HIV-1, 37 (5.1%) HIV-2 and 14 (1.9%) were HIV-1+HIV-2-positive. Both the increase of HIV-1 and the decline of HIV-2 between 1992-95 and 2005 were significant ($p < 0.001$; OR = 7.8, 95% CI 4.3-14.0 and $p < 0.01$; OR = 0.6, 95% CI 0.4-0.9, respectively, for paired comparison). However, since the mean age was significantly higher in 2005 than in 1992-1995 (38.2 versus 31.3 years; $p < 0.001$), we repeated the analyses in a logistic regression model controlling for age. The increase of HIV-1 and the decline of HIV-2 were still significant between 1992-95 and 2005 adjusted for age ($p < 0.001$; OR = 8.0, 95% CI 4.5-14.2 and $p < 0.001$; OR = 0.5, 95% CI 0.3-0.7, respectively). Also, when all HIV-positive subjects were taken together the increase of HIV between 1992-95 and 2005 was significant adjusted for age ($p < 0.05$; OR = 1.4, 95% CI 1.1-1.9). In Figure 2 the age distribution is shown according to HIV status and time period of inclusion. The HIV-1 prevalence was highest (1.6%) within the youngest age group in 1992-1995 and around 1% in the other age groups. In 2005 the HIV-1 prevalence was almost similar among all the different age groups. HIV-2 prevalence was lowest in the youngest age groups of both time periods (4.7% in 1992-1995 and 0% in 2005) and increased with age.

Potential factors that could influence the probability of acquiring HIV are presented in Table 1. In univariate analysis a significantly higher proportion of HIV-2-positive subjects had only 0-4 years of education in 1992-95 as compared to HIV-negative individuals ($p < 0.001$). Blood transfusion or circumcision were not shown to be associated with HIV prevalence, but unfortunately the question of circumcision was not included in the questionnaire of 2005 so only a limited number of persons was

Table 1. Risk factors for HIV in military personnel in Guinea-Bissau 1992-2005. HIV-1/HIV-2 dually reactive subjects are included in both the HIV-1-positive and the HIV-2-positive group (two subjects in 1992-95 and 14 subjects in 2005).

		Period	HIV-neg n/N	%	HIV-1 n/N	%	OR (95% CI)[a]	HIV-2 n/N	%	OR 95% CI[b]
Age	<30	1992-95	704/1429	49.3	10/19	52.6	1.1 (0.43-3.08)	42/133	31.6***	0.5 (0.32-0.71)
		2005	186/617	30.1	23/70	32.9	1.1 (0.65-1.98)	4/51	7.8**	0.2 (0.05-0.55)
		Total	890/2046	43.5	33/89	37.1	0.8 (0.48-1.21)	46/184	25.0***	0.4 (0.30-0.62)
Education	0-4 years in school	1992-95	189/1422	13.3	1/19	5.3	0.4 (0.01-2.32)	33/135	24.4***	2.1 (1.35-3.28)
		2005	174/618	28.2	22/70	31.4	1.2 (0.66-2.06)	21/51	41.2	1.8 (0.96-3.32)
		Total	363/2040	17.8	23/89	25.8	1.6 (0.96-2.69)	54/186	29.0***	1.9 (1.33-2.68)
Circumcision	No	1992-95	197/1105	17.8	4/17	23.5	1.4 (0.33-4.65)	22/105	21.0	1.2 (0.72-2.05)
Blood transfusion	Yes	1992-95	11/1439	0.8	0/19			3/135	2.2	2.9 (0.52-11.35)
		2005	10/618	1.6	2/70	2.9	1.8 (0.19-8.64)	2/51	3.9	2.5 (0.26-12.11)
		Total	21/2057	1.0	2/89	2.2	2.2 (0.25-9.35)	5/186	2.7	2.7 (0.78-7.41)
Number of partners outside of marriage last month	≥ 1	1992-95	579/1405	41.2	6/19	31.6	0.7 (0.20-1.87)	64/133	48.1	1.3 (0.91-1.92)
		2005	360/618	58.3	44/70	62.9	1.2 (0.71-2.09)	25/51	49.0	0.7 (0.37-1.27)
		Total	939/2023	46.4	50/89	56.2	1.5 (0.95-2.32)	89/184	48.4	1.1 (0.79-1.48)
Previous contact with a commercial sex worker	Yes	1992-95	9/362	2.5	0/6			1/30	3.3	1.3 (0.03-10.36)
		2005	274/616	44.5	41/70	58.6*	1.8 (1.04-3.00)	22/51	43.1	0.9 (0.51-1.75)
		Total	283/978	28.9	41/76	53.9***	2.9 (1.75-4.73)	23/81	28.4	1.0 (0.57-1.65)
Condom use	No	1992-95	1211/1422	85.2	14/18	77.8	0.6 (0.19-2.57)	107/135	79.3	0.7 (0.42-1.06)
	No	2005	325/618	52.6	33/70	47.1	0.8 (0.48-1.36)	29/51	56.9	1.2 (0.64-2.20)
		Total	1536/2040	75.3	47/88	53.4***	0.4 (0.24-0.59)	136/186	73.1	0.9 (0.63-1.27)
	Sometimes	1992-95	178/1422	12.5	3/18	16.7	1.6 (0.29-5.72)	25/135	18.5	1.6 (0.97-2.58)
	Sometimes	2005	209/618	33.8	22/70	31.4	0.9 (0.51-1.57)	15/51	29.4	0.8 (0.42-1.58)
		Total	387/2040	19.0	25/88	28.4*	1.7 (1.02-2.79)	40/186	21.5	1.2 (0.80-1.71)

[a] Odds ratio for paired comparison between HIV-1-positive and HIV-negative subjects
[b] Odds ratio for paired comparison between HIV-2-positive and HIV-negative subjects
* $p < 0.05$ of Chi-square test compared to HIV-negative subjects (Fisher's exact test when needed)
** $p < 0.01$ of Chi-square test compared to HIV-negative subjects (Fisher's exact test when needed)
*** $p < 0.0001$ of Chi-square test compared to HIV-negative subjects (Fisher's exact test when needed)

Table 1 (Continued). Risk factors for HIV in military personnel in Guinea-Bissau 1992-2005. HIV-1/HIV-2 dually reactive subjects are included in both the HIV-1-positive and the HIV-2-positive group (two subjects in 1992-95 and 14 subjects in 2005).

Heard of HIV	No	1992-95	50/357	14.0	2/6	33.3	3.1 (0.27-21.97)	3/27	11.1	0.8 (0.14-2.67)
		2005	3/616	0.5	0/69			0/51		
		Total	53/973	5.4	2/75	2.7	0.5 (0.06-1.87)	3/78	3.8	0.7 (0.14-2.23)
Heard of AIDS	No	1992-95	17/345	4.9	1/5	20.0	4.8 (0.09-51.93)	1/27	3.7	0.7 (0.02-5.13)
		2005	6/615	1.0	0/70			0/51		
		Total	23/960	2.4	1/75	1.3	0.5 (0.01-3.49)	1/78	1.3	0.5 (0.01-3.35)
Believe that AIDS exists	No	1992-95	59/370	15.9	1/6	16.7	1.0 (0.02-9.67)	5/32	15.6	1.0 (0.28-2.72)
		2005	12/618	1.9	2/70	2.9	1.5 (0.16-6.88)	0/51		
		Total	71/988	7.2	3/76	3.9	0.5 (0.10-1.68)	5/83	6.0	0.8 (0.25-2.11)
Know how HIV/AIDS transmits	No	1992-95	37/371	10.0	2/6	33.3	4.5 (0.39-32.51)	4/32	12.5	1.3 (0.31-3.98)
		2005	36/618	5.8	5/70	7.1	1.2 (0.37-3.34)	4/51	7.8	1.4 (0.34-4.08)
		Total	73/989	7.4	7/76	9.2	1.3 (0.48-2.91)	8/83	9.6	1.3 (0.57-3.01)
History of genital ulcer	Yes	1992-95	70/1428	4.9	2/19	10.5	2.3 (0.25-9.91)	22/135	16.3***	3.8 (2.18-6.50)
		2005	13/606	2.1	4/68	5.9	2.8 (0.66-9.57)	1/51	2.0	0.9 (0.02-6.31)
		Total	83/2034	4.1	6/87	6.9	1.7 (0.60-4.12)	23/186	12.4***	3.3 (1.97-5.54)
History of urethral discharge	Yes	1992-95	365/1432	25.5	7/19	36.8	1.7 (0.60-4.69)	56/134	41.8***	2.1 (1.44-3.06)
		2005	133/618	21.5	21/70	30.0	1.6 (0.87-2.78)	10/51	19.6	0.9 (0.41-1.90)
		Total	498/2050	24.3	28/89	31.5	1.4 (0.88-2.31)	66/185	35.7***	1.7 (1.24-2.40)
TPHA [c]	positive	1992-95	50/538	9.3	0/7			13/52	25.0**	3.2 (1.54-6.81)
		2005	81/618	13.1	7/70	10.0	0.7 (0.28-1.69)	11/51	21.6	1.8 (0.84-3.86)
		Total	131/1156	11.3	7/77	9.1	0.8 (0.30-1.75)	24/103	23.3***	2.4 (1.41-3.98)

[a] Odds ratio for paired comparison between HIV-1-positive and HIV-negative subjects
[b] Odds ratio for paired comparison between HIV-2-positive and HIV-negative subjects
[c] Treponema pallidum hemagglutination assay
* $p < 0.05$ of Chi-square test compared to HIV-negative subjects (Fisher's exact test when needed)
** $p < 0.01$ of Chi-square test compared to HIV-negative subjects (Fisher's exact test when needed)
*** $p < 0.0001$ of Chi-square test compared to HIV-negative subjects (Fisher's exact test when needed)

analyzed. The proportion of subjects with one or more partners in the last month previous to taking the survey (outside of marriage if married) was generally very high in all groups, and significantly more HIV-1-positive subjects reported previous contact with a commercial sex worker (CSW) compared to HIV-negative controls ($p < 0.001$). Surprisingly, no use of condoms was more frequent among HIV-negative soldiers compared to HIV-1-positive subjects. Knowledge about HIV/AIDS was generally satisfactory, and a trend of improvement was seen between 1992-1995 and 2005. Only a minority did not know how HIV/AIDS was transmitted, but there was a trend of a higher proportion among HIV-positive (33.3% of HIV-1-positive and 12.5% of HIV-2-positive) as compared to HIV-negative subjects (10.0%) in 1992-1995. In 2005, corresponding percentages declined to 7.1, 7.8% and 5.8% among HIV-1-positive, HIV-2-positive and HIV-negative persons, respectively.

A history of urethral discharge was frequent in all groups including HIV-negative individuals (range 24.3-35.7%), but the difference compared to HIV-negative individuals was only significant in HIV-2-positive individuals. Likewise, a history of genital ulcer disease as well as TPHA-reactivity was significantly higher among HIV-2-positive subjects compared to HIV-negative controls.

Thus several significant risk factors were found in univariate analyses among HIV-positive subjects, but performing a multivariate logistic regression analysis adjusting for all significant risk factors found (age, education, ≥ 1 number of partners in the last month, previous contact with a CSW, a history of genital ulcer or urethral discharge and TPHA-reactivity), the only risk factor that remained significant was previous contact with a CSW among HIV-1-positive subjects (single and dually reactive analysed together) compared to HIV-negative subjects (adjusted OR = 2.1, 95% CI 1.2-3.6; $p < 0.01$).

Discussion

This study has revealed an alarming increase of HIV-1 from 1.2% in 1992-1995 to 9.6% in 2005 (including HIV-1+HIV-2-positive subjects) among the military in Guinea Bissau. Simultaneously the prevalence of HIV-2 declined from 8.5% to 7.0%. These results coincide with the changes of HIV prevalence observed in a cohort study of police officers in Guinea-Bissau between 1990 and 2007 [8]. Similar changes of prevalence rates of HIV-1 and HIV-2 were also found among pregnant women in the capital Bissau and in two recently published population-based studies from urban and rural Guinea-Bissau, although the prevalence rates were generally higher in our study [4-6]. This is in agreement with previous studies which have found higher prevalence rates of HIV among uniformed personnel compared to the general population or pregnant women [9]. A limitation of our study was that we only measured the prevalence at two time points (1992-1995 and 2005) with a fairly long interval between. Thus we cannot say if the trend of HIV-1 is still rising or not. However, both in the study of police officers and among pregnant women in Guinea-Bissau a stabilization of HIV-1 has been observed in recent years [4,8]. In the neighbouring countries of Senegal and The Gambia, HIV-1 and HIV-2 prevalence rates have continued on a comparatively low level in pregnant women (around or below 1 %) [10,11]. However, similar trends of increasing HIV-1 prevalence and a decreasing HIV-2 prevalence was reported among clinical patients in The Gambia as well as in a cohort of female commercial sex workers in Senegal [12,13].

Guinea-Bissau experienced a civil war in 1998-1999, causing major population displacements and general decline in public services such as health institutions during that time [14,15]. This could be one explanation for the dramatic increase of HIV-1 among military personnel over the study period. The relationship between HIV and conflict is complex. As opposed to earlier beliefs that conflicts in general should aggravate HIV transmission, several publications have described how conflicts may actually limit the spread of HIV during the period of conflict [16]. However, there is substantial evidence of mobility as an important factor increasing the risk of HIV transmission [17], and in the conflict in Guinea-Bissau approximately 250,000 inhabitants of the capital Bissau repeatedly left for the interior of the country during several outbreaks of conflict. The reason we didn't find a similar increase of HIV-2 after the war was probably because of the much lower transmission risk of HIV-2 as compared to HIV-1 [18)] Other reasons for the increase of HIV-1 could be changes in sexual risk behaviour or cultural factors, but data on these parameters are scarce in Guinea-Bissau.

HIV-2 was found to be more prevalent among the older age groups, and in the 2005 survey very few HIV-2-positive subjects younger than 35 years of age were found (no subjects younger than 25 years of

age). Conversely, HIV-1 was more or less evenly distributed across the age groups. One explanation could be a cohort effect due to the slower disease progression in HIV-2 compared to HIV-1. Another reason could be attributed to the spread of HIV-2 during the war of independence in the 1960s and early 1970s in Guinea-Bissau, when HIV-2 already existed in Guinea-Bissau [18]. It has been suggested that transmission of HIV-2 then might have been driven by multiple mechanisms, such as inoculation campaigns, non-sterile surgical procedures or injections, blood transfusions and sexual transmission [19]. None of the neighbouring countries had a similar period of prolonged armed conflict during the sixties and the seventies. Thus, the declining prevalence of HIV-2 that we have observed in this study could be the return of the HIV-2 prevalence to a steady state level similar to levels in The Gambia and Senegal. In a recent mathematical simulation model regarding a rural population in Guinea-Bissau, it was suggested that 30% of the decline in HIV-2 prevalence is due to competition from HIV-1 including the excess mortality of core groups transmitting both HIV-1 and HIV-2. Seventy percent of the decline should be due to a behavioural change from a conflict setting to a peacetime situation after the end of the war of independence in 1963-1974 [20].

Even though the majority of the participants knew about HIV/AIDS transmission methods and a trend of better knowledge was noted over the study period, sexual risk taking was high. This could also be an explanation for the increasing prevalence of HIV-1. Almost half the participants reported one or more sexual partners outside of their marriage in the last month while approximately one third had previous contact with a CSW. Furthermore, for both these risk factors the trend was unfortunately increasing between 1992-1995 and 2005. Most participants did not use condoms and another minority only sometimes used condoms. The collection of this kind of data is always connected with a certain amount of unreliability. Since both underreporting and exaggerations are possible, the effect of bias is hard to anticipate. Regarding history of genital ulcer or urethral discharge, it is more likely that events will be forgotten as time passes, and therefore underreporting is plausible. Even so, more than three times more HIV-2 infected subjects and almost two times more HIV-1-positive persons reported a history of genital ulcer as compared to HIV-negative subjects. This association (only significant in HIV-2-positive subjects) might be a sign of high sexual risk behaviour, but it is also well known that disrupted mechanical barriers by a genital ulcer increase the risk of acquiring HIV [21]. However, in a multivariate regression analysis the only risk factor that remained significant was previous contact with a CSW, which demonstrates the importance of reaching CSWs in the preventive efforts in controlling the epidemic of HIV-1.

In most other countries in Africa, the prevalence of HIV is higher among military personnel than in the general population [2]. However, there are some examples where prevention campaigns among the armed forces have led to improved knowledge of HIV/AIDS as well as a decline in STI-incidence [22,23]. Our observations indicate that military leadership must recognize the urgent need to increase HIV/AIDS prevention efforts through the promotion of programs focusing on HIV/AIDS and STI prevention and treatment among the armed forces. Counseling, voluntary and confidential HIV testing of military personnel, socio-economic assistance to families and survivors of ill soldiers and start of antiretroviral therapy among military personnel are also recommended.

No association could be found between circumcision and HIV. However, since the majority of males in Guinea-Bissau are traditionally circumcised during adolescence, few subjects were not circumcised (totally 19.1%) and therefore the statistical power for this comparison was weak. In addition, the question regarding circumcision was included only in the 1992-1995 survey, and at that time (1992-1995) HIV-1 was very rare so the probability to detect a great difference in HIV-1-prevalence was quite small. It has never been shown that circumcision might be a protective factor against HIV-2.

In conclusion, the prevalence of HIV-1 increased significantly while the prevalence of HIV-2 decreased significantly between 1992-1995 and 2005 among military personnel in Guinea-Bissau. Sexual risk taking was high and previous contact with a prostitute was an independent risk factor for HIV-1. These observations call for attention and point to an urgent need to increase HIV/AIDS prevention efforts among the armed forces in Guinea-Bissau.

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