Published by Oxford University Press on behalf of the International Epidemiological Association *International Journal of Epidemiology* 2006;**35:**1322–1328

doi:10.1093/ije/dyl037

OTHER ORIGINAL PAPERS

Sixteen years of HIV surveillance in a West African research clinic reveals divergent epidemic trends of HIV-1 and HIV-2

Maarten F Schim van der Loeff,* Akum Aveika Awasana, Ramu Sarge-Njie, Marianne van der Sande, Assan Jaye, Saihou Sabally, Tumani Corrah, Samuel J McConkey and Hilton C Whittle

Accepted 10 Feburary 2006

Background The HIV-1 epidemic in West Africa is characterized by a slower rise than that in Eastern and Southern Africa. The HIV-2 epidemic in West Africa may be declining, but few long-term data exist.

Methods In a research clinic in The Gambia, HIV-1 and HIV-2 prevalence trends among all new patients being tested for HIV were examined over a 16 year period (1988 till 2003). In newly diagnosed patients a baseline CD4 count was done.

Results An HIV test was done in 23 363 patients aged 15 years or older. The prevalence of HIV-1 was 4.2% in 1988–91 and rose to 17.5% in 2001–03 ($P < 0.0001$, χ^2-test for trend). The prevalence of HIV-2 was 7.0% in 1988–91 and declined to 4.0% in 2001–03 ($P < 0.0001$). HIV-1 prevalence increased and HIV-2 prevalence decreased with time in logistic regression models adjusting for age, sex, and indication for test ($P < 0.0001$). Baseline CD4 counts were available for 65% of patients. The median CD4 count was 215 cells/mm^3 [interquartile range (IQR) 72–424] for HIV-1, and 274 (IQR 100–549) for HIV-2 infected patients. There was no marked trend of rise or decline in baseline CD4 count in either HIV-1 or HIV-2 infected patients over the study period. Forty-five per cent of newly diagnosed HIV patients had a CD4 count <200 cells/mm^3.

Conclusions These data suggest that HIV-1 prevalence is rising in The Gambia, and that HIV-2 is declining. HIV patients in The Gambia present late and almost half of patients would qualify for anti-retroviral treatment at their first visit.

Keywords HIV-1, HIV-2, Africa, The Gambia, prevalence, CD4 lymphocyte count

Introduction

The HIV-1 epidemic in Western Africa has been less severe than the epidemic in Eastern and Southern Africa. General population prevalences rarely exceed 10%, and are well below 5% in many countries.[1] In Senegal sentinel surveillance data among pregnant women suggest a stable HIV-1 prevalence below 1%,[2] whereas the HIV-1 prevalence among pregnant women attending antenatal clinics have increased moderately in neighbouring The Gambia (from 0.7 to 1.0% between 1994 and 2000)[3] and steeply in Guinea-Bissau (from 0.0% in 1987 to 4.6% in 2001).[4]

The prevalence of HIV-2 appears to be declining in the sub-region.[5] In a community-based study in Bissau a significant decline in prevalence and incidence was observed between 1987 and 1996.[6] Among pregnant women attending antenatal clinics in Bissau also a significant decline was found, from 8.3% in 1987 to 3.3% in 2001.[4] Gambian sentinel data among pregnant women showed a non-significant

MRC Laboratories, PO Box 273, Banjul, The Gambia.

* Corresponding author. International Antiviral Therapy Evaluation Centre, Pietersbergweg 9, 1105 BM Amsterdam, The Netherlands. E-mail: m.schim@iatec.com

decline of HIV-2 from 1.0% in 1993–95 to 0.8% in 2000–01.[3] In Dakar, Senegal, HIV-2 prevalence among pregnant women was stable below 1.0% between 1989 and 1996.[2]

Measuring HIV prevalence among patients attending sexually transmitted disease (STD) clinics can be used as an additional surveillance method, and in countries with low or concentrated HIV-1 epidemics (defined as HIV-1 prevalence consistently <1% in pregnant women in urban areas), this may be a more sensitive method of detecting trends than sentinel surveillance among pregnant women.[7]

We examined HIV prevalence trends among patients attending the Medical Research Council (MRC) clinical facilities in Fajara, The Gambia, in order to establish whether in this clinical research population HIV-1 is increasing and HIV-2 decreasing. The MRC Laboratories in The Gambia has conducted clinical research on HIV since 1987,[8] and large numbers of patients have been tested since then. The testing policies and guidelines at MRC have changed over the years, and research projects have focused on various groups. Also, health-seeking behaviour of patients may have changed over the years. These factors may have lead to changes in the patient mix attending our clinics. We handled this potential bias in two ways. First, we examined trends of HIV-1 and HIV-2 prevalence stratified by the reason for HIV testing. Second, we examined the CD4 count in newly diagnosed HIV patients. If changes in testing policy or health-seeking behaviour have lead to earlier HIV diagnosis, the median CD4 count of patients will have increased over the years.[9,10] If the CD4 count remained the same throughout the period, it can be assumed that a rise or decline in HIV-1 or HIV-2 prevalence is less likely to be due to changes in health seeking behaviour or patient mix and may reflect true changes in HIV prevalence in the community.

Methods

Setting

The first HIV infection in The Gambia was detected in 1986. Routine testing by enzyme-linked immunosorbent assay (ELISA) was in place from 1988 at the MRC Laboratories in Fajara, near the capital Banjul. The MRC opened a genito-urinary medicine (GUM) clinic, which later on became the national referral centre for HIV care. Patients attending the clinics and ward of the MRC were tested for a variety of reasons, which have been grouped as: (i) sexually transmitted infection (STI) other than HIV; (ii) active as a female commercial sex worker (CSW); (iii) clinical signs or symptoms suggestive of HIV infection ('clinical'); (iv) other reasons. The reason for testing, as well as age, sex, and date of blood sample, were noted on the laboratory request form.

Studies in 1988, 1989, and 1992–93 among CSWs in The Gambia[11–13] led to an increase in the number of CSWs attending the clinics in those years. From 1997 onwards an HIV test was offered to all patients attending the GUM clinic, irrespective of the complaint or diagnosis. All patients were pre-test counselled. Over 95% of patients agreed to be tested, but one-third of these did not return to obtain their result.

From this analysis we excluded test results from patients who were not registered as a patient of MRC clinics (e.g. subjects enrolled in field studies, or patients from other clinics whose samples were tested at the MRC serology laboratory) and patients who were first tested before January 1988 or after December 2003. Only one sample per patient was included in this analysis; second or later samples of the same individual were ignored.

Serological methods

Serum was screened by the Wellcozyme HIV 1+2 (Murex Diagnostics Ltd, Dartford, UK) until August 1996, then by ICEHIV1.O.2 (Murex) until April 2001, and after that date by the ICEHIV-1.2.O (Abbott Murex, Dartford, UK). If reactive, samples were re-tested by type-specific ELISAs. For HIV-1 this was the Wellcozyme HIV recombinant-1 (Murex), and for HIV-2 the Wellcozyme HIV-2 (Murex) from the start till April 1996, with ICE*HIV-2 (Murex) till April 2001, and after that date with Murex HIV-2 (Abbott Murex). Samples that were clearly reactive in only one type-specific ELISA were assigned a serological diagnosis accordingly. Samples positive in both ELISAs were further tested by a synthetic peptide-based strip method, Pepti-Lav 1-2 (Sanofi Diagnostics Pasteur, Marne la Coquette, France), until December 1999. We interpreted the appearance of a clear band (++) or a very clear band (+++) as evidence of infection with the relevant HIV type; samples with clear or very clear lines for both virus types were considered as dually infected. From January 2000 onwards we replaced Pepti-Lav by serial dilution of samples.[14] Samples with inconclusive ELISA, Pepti-Lav, or sero-dilution results were classified as indeterminate.

CD4 measurement

Lymphocyte subset measurements by flow cytometry on site were started routinely in November 1988. The CD4 percentage was estimated by FACScan (Becton Dickinson, Oxford, UK) until August 1997 and since then by FACS Calibur (Becton Dickinson). CD4 percentage measurements were performed as soon as possible after HIV diagnosis. The CD4 count was calculated from the white blood cell count and the lymphocyte percentage. The CD4 count was only included in the analysis if it was done within 6 months of the first positive HIV test.

Statistical analysis

Proportions were compared using the χ^2-test and trends in proportions by the χ^2-test for trend. Distributions of continuous variables (age and CD4 count) were compared between groups using the ranksum test. The 16 years of the study period were divided in one 4 year (1988–91) and four 3 year periods for analysis and presentation. Age was grouped in five age groups (15–24, 25–34, 35–44, 45–54, and 55 years or older). As CD4 counts were right skewed, they were log-transformed, after which they were approximately normal. Only patients with a certain HIV diagnosis were included in the analysis. Patients who had both HIV-1 and HIV-2 infection were included in analyses of both HIV types. Logistic regression was used to examine whether period was independently associated with HIV-1 or HIV-2 infection. Multiple linear regression was used to examine whether the CD4 count of newly diagnosed HIV patients changed significantly over the periods, after adjustment for age and sex.

Table 1 Number and characteristics of patients tested, and HIV-1 and HIV-2 prevalence, by period, The Gambia 1988–2003

	1988–91	1992–94[a]	1995–97	1998–2000	2001–03	*P*
Number	3775	3807	4609	5669	5503	
% Female[b]	1775 (47.9%)	1888 (51.2)%	2524 (55.6%)	3494 (61.8%)	3686 (67.0%)	<0.0001[c]
Median age in years (IQR)[d]	29 (24–37)	30 (25–38)	29 (24–36)	29 (23–36)	28 (23–36)	
Reason for testing (%)[e]						
STI	NA	539 (21.3%)	1939 (42.1%)	2546 (44.9%)	1834 (33.3%)	
CSW	NA	203 (8.0%)	134 (2.9%)	185 (3.3%)	122 (2.2%)	
Clinical	NA	744 (29.4%)	480 (10.4%)	1024 (18.1%)	1172 (21.3%)	
Other	NA	1041 (41.1%)	1956 (42.4%)	1658 (29.3%)	2215 (40.3%)	
Unknown	NA	7 (0.3%)	100 (2.2%)	256 (4.5%)	160 (2.9%)	<0.001[f]
HIV prevalence						
HIV-1 infection[g]	157 (4.2%)	306 (8.0%)	488 (10.6%)	821 (14.5%)	964 (17.5%)	<0.0001[c]
HIV-2 infection[g]	265 (7.0%)	281 (7.4%)	289 (6.3%)	503 (5.3%)	222 (4.0%)	<0.0001[c]
HIV-D infection	31 (0.8%)	33 (0.9%)	51 (1.1%)	70 (1.2%)	51 (0.9%)	0.29[c]
HIV-1						
Median CD4 count (cells/mm^3) at baseline[h]	249 (116–495)	216 (59–409)	207 (58–423)	218 (80–439)	212 (73–413)	0.72[i]
% with CD4 count <200 cells/mm^3 [h]	29 (40.3%)	107 (45.7%)	166 (48.7%)	260 (46.3%)	288 (47.8%)	0.71[f]
HIV-2						
Median CD4 count (cells/mm^3) at baseline[j]	328 (139–597)	261 (83–517)	289 (115–564)	296 (120–614)	187 (84–456)	0.51[i]
% With CD4 count <200 cells/mm^3 [j]	38 (39.6%)	88 (43.4%)	75 (38.1%)	78 (37.3%)	70 (50.7%)	0.12[f]

IQR = interquartile range, STI = sexually transmitted infection, CSW = commercial sex worker, HIV-D = dual infection with both HIV-1 and HIV-2, NA = not available.

[a] Reason for testing reflects data from 1993–94 only.

[b] Sex not available for 274.

[c] χ^2-test for trend.

[d] Age not available for 3011.

[e] Reason not available for patients tested prior to 1993, and not available for 523 since January 1993.

[f] χ^2-test.

[g] Includes HIV-1 and HIV-2 dual infected patients.

[h] CD4 count not available for 925 (34%) of 2736 HIV-1 infected patients.

[i] Linear regression.

[j] CD4 count not available for 516 (38%) of 1360 HIV-2 infected patients.

Ethics

All patients were counselled and provided informed consent for HIV testing. This study was approved by the Gambia Government/MRC Ethics Committee.

Results

Patient characteristics

Between January 1, 1988 and December 31, 2003, 24 178 patients at the MRC clinics or ward had a valid HIV test result. Eight hundred and fifteen patients (3.4%) were younger than 15 years at the time of testing. These were excluded, as the risk factors for HIV infections are very different for children. Thus, the analyses below are based on the 23 363 adult patients. Fifty-eight percentage of patients (13 367 of 23 089) were female; the median age was 32 years [interquartile range (IQR) 26–41] for men and 27 (IQR 22–34) for women (ranksum test, $P < 0.0001$). The number of newly tested patients increased over the years from 267 in 1988 to 1747 in 2003. The reason for testing is not available in electronic files for most patients tested before 1993, but from January 1993 onwards a reason for testing was available for most patients: 6858 (37.4%) were tested because they had an STI, 644 (3.5%) because they were involved in commercial sex work, 3420 (18.7%) as they had clinical signs or symptoms suggestive of HIV disease, and 6870 (37.5%) for other reasons (e.g. screening prior to blood donation, being a sexual contact of an HIV or STI patient). The reason was not recorded for 523 (2.9%) of the patients.

Changes in patient population over time

Over the study period the proportion of females among the patients increased from 48% in the period 1988–91 to 67% in 2001–03 (χ^2-test for trend: $P < 0.0001$). The median age increased slightly over time in men (1 month per calendar year; $P = 0.04$) and decreased slightly among women (1.5 month per calendar year; $P < 0.001$). The proportion of patients who were tested because they were CSWs declined over the years; the proportion of patients in the other three categories fluctuated (Table 1).

Trends of HIV-1 prevalence over time

The prevalence of HIV-1 increased from 4.2% in 1988–91 to 17.5% in 2001–03 (χ^2-test for trend; $P < 0.0001$; Table 1 and Figure 1). In bi-variate analyses HIV-1 infection was

Table 2 Prevalence of HIV-1 and HIV-2 among patients of the MRC clinics, 1992–2003, by indication for test

Reason for testing	1992–94	1995–97	1998–2000	2001–03	Total period	χ^2-test for trend
Sexually transmitted infections	539	1939	2546	1834	6858	
HIV-1	14 (2.6%)	78 (4.0%)	109 (4.3%)	132 (7.2%)	333 (4.9%)	<0.0001
HIV-2	21 (3.9%)	44 (2.3%)	48 (1.9%)	33 (1.8%)	146 (2.1%)	0.017
Female commercial sex worker	202	134	184	123	644	
HIV-1	14 (6.9%)	15 (11.2%)	26 (14.1%)	20 (16.4%)	75 (11.7%)	0.006
HIV-2	29 (14.3%)	7 (5.2%)	6 (3.2%)	6 (4.9%)	48 (7.5%)	<0.0001
Signs or symptoms of HIV disease (clinical)	744	480	1024	1172	3420	
HIV-1	72 (9.7%)	94 (19.6%)	270 (26.4%)	386 (32.9%)	822 (24.0%)	<0.0001
HIV-2	42 (5.7%)	52 (10.8%)	96 (9.4%)	86 (7.3%)	276 (8.1%)	0.64
Other reasons	1038	1956	1658	2215	6870	
HIV-1	121 (11.6%)	288 (14.7%)	414 (25.0%)	419 (18.9%)	1242 (18.1%)	<0.0001
HIV-2	86 (8.3%)	182 (9.3%)	153 (9.2%)	97 (4.4%)	518 (7.5%)	<0.0001

Patients with dual HIV infection are included among both HIV-1 and HIV-2. As the reason for testing is unknown for most of patients in the period 1988–91, this period has been omitted from the table.

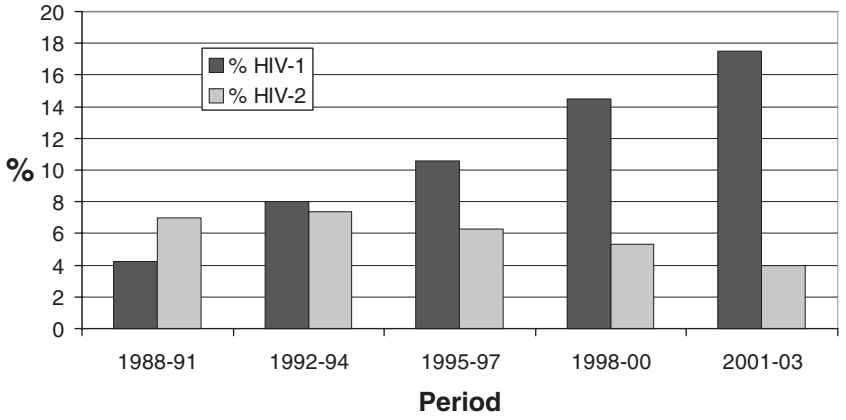

Figure 1 Prevalence of HIV-1 and HIV-2 among patients attending MRC clinics The Gambia, 1988–2003 (Patients infected with both HIV-1 and HIV-2 are included in both HIV categories)

significantly associated with male sex (χ^2-test, $P = 0.003$), higher age (ranksum test, $P < 0.0001$), later calendar year ($P < 0.0001$), and reason for testing other than STI ($P < 0.001$). The increase of HIV-1 prevalence occurred in all four test categories of reasons for testing (test of trend, $P < 0.01$; Table 2). In a logistic regression model adjusting for sex, age, and reason for testing, the period was significantly associated with HIV-1 ($P < 0.0001$), with the odds ratio (OR) being 1.4 [95% confidence interval (95% CI) 1.1–1.6] for 1995–97, 1.8 (95% CI 1.6–2.2) for 1998–2000, and 1.9 (95% CI 1.6–2.2) for 2001–03, when compared with the prevalence in 1992–94. This model omitted the period 1988–91 as no reason for testing was available for that period.

Trends of HIV-2 prevalence over time

In contrast, the prevalence of HIV-2 decreased from 7.0% in 1988–91 to 4.0% in 2001–03 (χ^2-test for trend; $P < 0.0001$; Table 1 and Figure 1). The decrease occurred in the test categories STI (χ^2-test for trend, $P = 0.017$), CSW ($P < 0.0001$), and 'other reasons' ($P < 0.0001$), but not in those tested for clinical reasons ($P = 0.64$; Table 2). In bi-variate analyses HIV-2 infection was associated with female sex (χ^2-test, $P = 0.04$), higher age (ranksum test, $P < 0.0001$), earlier calendar year ($P < 0.0001$), and reason for testing other than STI ($P < 0.0001$). In a logistic regression model adjusting for sex, age, and reason for testing, there was a significant decrease of HIV-2 infection with time ($P < 0.0001$), the OR being 0.90 (95% CI 0.7–1.1) for 1995–97, 0.70 (95% CI 0.58–0.86) for 1998–2000, and 0.43 (95% CI 0.35–0.53) for 2001–03, when compared with the prevalence in 1992–94. In separate models for each of the reasons for testing, the same trend was found.

Prevalence of HIV-1 and HIV-2 dual infection over time

The prevalence of dual infection varied between 0.8% (in 1988–91) and 1.2% (1998–2000). There was no trend in rise

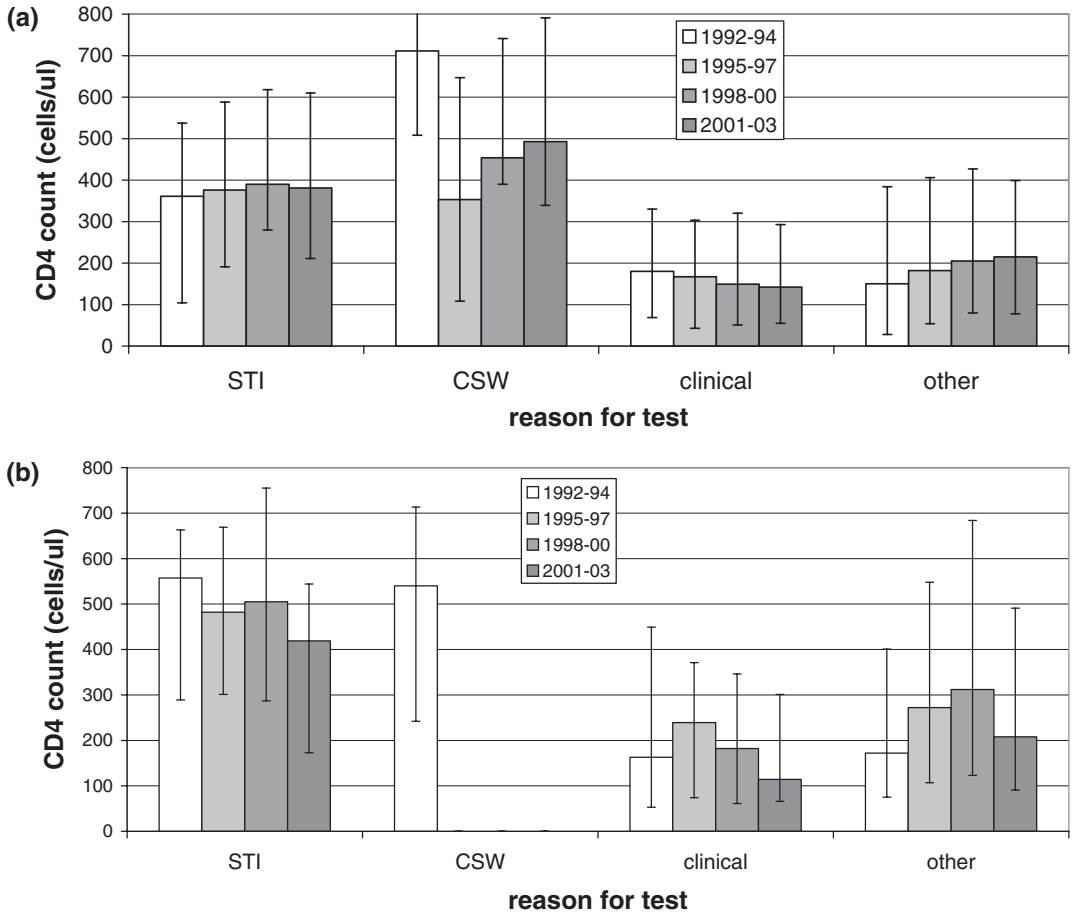

Figure 2 (a) Median CD4 count [and interquartile range (IQR)] of newly diagnosed HIV-1 patients, 1992–2003, by period and reason for testing. (b) Median CD4 count (and IQR) of newly diagnosed HIV-2 patients, 1992–2003, by period and reason for testing [The number of newly diagnosed commercial sex workers in the last three periods was too small for meaningful presentation (one, three, and one, respectively)]

or decrease of prevalence over the years in bi-variate analysis (χ^2-test for trend, $P = 0.29$).

CD4 count at time of diagnosis

Valid CD4 counts within 6 months of HIV diagnosis were available for 64.9% of the HIV infected patients (2507 of 3860). Patients without a CD4 count at the time of HIV diagnosis were younger (32 vs 33 years, ranksum test, $P = 0.013$), were more likely to be HIV-2 than HIV-1 infected (38% vs 33%, χ^2-test, $P = 0.007$), and were more often tested because they were CSWs or for clinical reasons than because they had an STI or for 'other reasons' (χ^2-test, $P < 0.001$); there was no difference according to gender (χ^2-test, $P = 0.60$). The proportion without a CD4 count at the time of diagnosis varied over time, but there was no trend over time (χ^2-test for trend, $P = 0.34$). The median time between HIV diagnosis and CD4 count was 9 days (IQR 0–18 days). The median CD4 count at the time of diagnosis was 215 cells/mm^3 in HIV-1 patients (IQR 72–424 cells/mm^3) and 274 cells/mm^3 in HIV-2 patients (IQR 100–549). The CD4 count was <200 cells/mm^3 in 45% of patients (47% of HIV-1 and 41% of HIV-2 infected patients). In bi-variate analyses, men had significantly lower CD4 counts than women (162 vs 288 cells/mm^3; ranksum test, $P < 0.0001$), and CD4 count decreased with age (linear regression, $P < 0.001$). The CD4 count was higher in people tested because they had an STI or were CSWs (410 and 508 cells/mm^3, respectively), but was lower in those tested because of clinical or 'other' reasons (151 and 215 cells/mm^3, respectively). Among patients who were tested because of clinical suspicion of HIV disease, 59% had a CD4 count <200 cells/mm^3 and, thus, would have qualified for anti-retroviral treatment (ART) (the proportion was similar for HIV-1 and HIV-2 infected patients; $P = 0.87$). For patients in the other test categories the proportions were 19% (STI), 16% (CSW), and 48% (other reasons).

There was no marked trend over time in the CD4 count among newly diagnosed HIV-1 or HIV-2 patients (Figure 2 and Table 3). In a multiple linear regression analysis adjusting for age and sex, the time period was not a significant predictor of baseline log CD4 count in HIV-1 in the testing categories STI and clinical reason (likelihood ratio tests, $P = 0.19$ and 0.68, respectively). In the category 'other reasons' CD4 count was slightly higher in later periods (likelihood ratio test, $P = 0.02$), but there were not enough patients in the category CSW to test the effect of period. Among HIV-2 infected patients period was not significantly associated with CD4 count among

Table 3 Median CD4 count and IQR (cells/mm^3) of newly diagnosed patients at MRC clinics, 1992–2003, by period and reason for testing

Reason for testing	All periods	1992–94	1995–97	1998–2000	2001–03	*P*
Sexually transmitted infections						
HIV-1	384 (212–609)	361 (104–537)	376 (191–588)	390 (280–618)	381 (211–610)	0.31
HIV-2	475 (267–656)	557 (289–663)	482 (301–669)	505 (287–755)	419 (173–544)	0.96
Female commercial sex worker						
HIV-1	484 (331–741)	711 (508–1129)	353 (108–647)	434 (390–741)	493 (339–791)	0.76
HIV-2	621 (267–726)	540 (242–713)	[a]	[a]	[a]	0.84
Signs or symptoms of HIV disease						
HIV-1	156 (54–316)	180 (69–330)	167 (43–303)	149 (51–320)	142 (55–293)	0.78
HIV-2	165 (60–356)	163 (53–449)	239 (74–371)	182 (61–346)	114 (55–290)	0.26
Other reasons						
HIV-1	199 (65–404)	150 (28–384)	182 (54–406)	205 (80–427)	215 (78–399)	0.003
HIV-2	252 (97–546)	172 (75–401)	272 (108–549)	312 (123–684)	208 (91–491)	0.14

[a] Numbers too low for meaningful comparisons (1, 3, and 1 in the three last periods). *P*-values obtained from linear regression.

those tested for STI or clinical reasons (LRT, $P = 0.23$ and 0.24), but among those tested for other reasons the CD4 count was higher in later periods (LRT, $P = 0.003$); again there were not enough patients in the category CSW to test this effect.

Discussion

In this patient population of an STD research clinic, the HIV-1 prevalence rose from 4.2% in 1988–91 to 17.5% in 2001–03. This rise is not due to HIV-1 infected persons being tested at an earlier stage in their disease, as the CD4 count among newly diagnosed HIV-1 patients did not increase in this period. The rise of the prevalence was observed in each of four test categories, so changes in patient mix are not responsible for this. Thus a real increase of HIV-1 in The Gambia is likely, which is supported by sentinel surveillance data among pregnant women in The Gambia.[3] The prevalence of HIV-2 declined from 7.0 to 4.0%, while the CD4 count of the newly diagnosed HIV-2 patients remained the same. This suggests that the HIV-2 prevalence in the population has declined, which is also supported by sentinel data among pregnant women.[3]

The CD4 count at the time of HIV diagnosis was <200 cells/mm^3 in 45% of patients with HIV infection of whom a baseline CD4 count was available. All these patients would be eligible for ART according to the WHO guidelines.[15] It appears that HIV patients in The Gambia present at clinics in a late stage of disease. This phenomenon may in fact be stronger than our overall data suggest, as in a research setting more patients are likely to be tested than in routine clinics. Among patients who were tested because of clinical suspicion of HIV disease, the median CD4 count was 151 cells/mm^3 and 59% of these patients would have qualified for immediate ART; there was no change over the years in this proportion. These data indicate the potential workload for the health services when ART is introduced in The Gambia.

The overall proportion of people infected with both HIV-1 and HIV-2 (1.0%) did not change over the years. It is remarkable that the proportion of dually infected patients was lower than that of HIV-2 singly infected patients. This is in sharp contrast to earlier findings among various adult patient groups in Abidjan, Cote d'Ivoire, where the prevalence of dual infection was nearly always markedly higher than that of single HIV-2 infection.[16]

This study was based in a research clinic in the urban area of The Gambia, and the patients form a selected group of the total population. Over the years the HIV testing policies and the patient mix of the clinics have changed (more women, more people with STIs, less CSWs), as the MRC became established as the national referral centre for HIV care. These potential biases have been addressed in two ways: (i) by analysing prevalence trends within test indication categories and (ii) by showing that the median CD4 count of newly diagnosed HIV patients did not change over time. Analysed thus, the patients at the MRC clinics form a useful sentinel population, whose trends reflect trends in the general population. The prevalence of HIV-1 among pregnant women in The Gambia also increased (from 0.7 to 1.0% between 1994 and 2000) and the prevalence of HIV-2 decreased (from 1.0 to 0.8%).[3] The explanation for the divergent trends may be sought in the lower sexual transmission rate of HIV-2, which is estimated to be one-third that of HIV-1.[17] Nevertheless, this trend raises the question about the events that created the initial epidemic in West Africa, and what has changed that the epidemic is no longer sustained. This question is not resolved.[18,19]

CD4 counts were not available for one-third of HIV infected patients, but it is not evident in which direction this bias might have worked. Even if one would assume that all of those had CD4 counts >200 cells/mm^3, still 31% of HIV-1 and 25% of HIV-2 infected patients would have qualified for ART.

Conclusions

HIV-1 has risen strongly among patients of the MRC clinics in The Gambia between 1988 and 2003. This suggests a rise in the

general population prevalence of HIV-1, supported by sentinel surveillance data among pregnant women 1993–2001.[3] Conversely, HIV-2 has declined in the same period among MRC patients, suggesting a decline in population prevalence. In The Gambia, patients with HIV tend to report to a clinic at a late stage of disease.

Acknowledgements

We thank the clinicians, nurses, and assistants of MRC both in the clinics and the ward for testing and counselling, and Mr David Jeffries for support and advice. We acknowledge the continuing support of Mr Saihou Ceesay, the director of the Gambian National AIDS Secretariat. This study was funded by MRC (UK).

KEY MESSAGES

- In West Africa both HIV-1 and HIV-2 are prevalent.
- In a research clinic population in The Gambia the prevalence of HIV-1 among new patients increased from 4.2 to 17.5% in a 16 year period.
- In the same period in the same population, the prevalence of HIV-2 declined from 7.0 to 4.0%.
- These trends cannot be explained by changes in patient population, and are thought to reflect general population trends.
- Forty-five percentage of newly diagnosed HIV patients have a CD4 count <200 cells/μl, and are eligible for anti-retroviral treatment according to WHO guidelines.

References

[1]UNAIDS and WHO. *AIDS Epidemic Update December 2003*. Geneva: UNAIDS & WHO, 2003.

[2]Meda N, Ndoye I, M'Boup S, Wade A, Ndiaye S, Niang C *et al*. Low and stable HIV infection rates in Senegal: natural course of the epidemic or evidence for success of prevention? *AIDS* 1999;**13:** 1397–405.

[3]Schim van der Loeff MF, Sarge-Njie R, Ceesay S, Awasana AA, Jaye P, Sam O *et al*. Regional differences in HIV trends in The Gambia: results from sentinel surveillance among pregnant women. *AIDS* 2003;**17:** 1841–46.

[4]Norrgren H, Da Silva ZJ, Biague AJ, Andersson S, Biberfeld G. Trends of HIV-1 and HIV-2 in Guinea-Bissau 1987–2001. 3rd Virtual AIDS Congress, Portugal 2002. Available at: http://www.aidscongress.net/pdf/110.pdf (Accessed March 31, 2004).

[5]Schim van der Loeff MF, Aaby P. Towards a better understanding of the epidemiology of HIV-2 [review]. *AIDS* 1999;**13 (Suppl A):** S69–84.

[6]Larsen O, da Silva Z, Sandstrom A, Andersen PK, Andersson S, Poulsen AG *et al*. Declining HIV-2 prevalence and incidence among men in a community study from Guinea-Bissau. *AIDS* 1998;**12:** 1707–14.

[7]UNAIDS/WHO Working Group on Global HIV/AIDS and STI Surveillance. *Second generation surveillance for HIV. Compilation of Basic materials*. CD ROM. Geneva: UNAIDS & WHO, 2001.

[8]Mabey DC, Tedder RS, Hughes AS, Corrah PT, Goodison SJ, O'Connor T *et al*. Human retroviral infections in The Gambia: prevalence and clinical features. *BMJ* 1988;**296:**83–86.

[9]Easterbrook PJ, Yu LM, Goetghebeur E, Boag F, McLean K, Gazzard B. Ten-year trends in CD4 cell counts at HIV and AIDS diagnosis in a London HIV clinic. *AIDS* 2000;**14:**561–71.

[10]Gupta SB, Gilbert RL, Brady AR, Livingstone SJ, Evans BG. CD4 cell counts in adults with newly diagnosed HIV infection: results of surveillance in England & Wales, 1990–1998. *AIDS* 2000;**14:** 853–61.

[11]Pepin J, Dunn D, Gaye I, Alonso P, Egboga A, Tedder R *et al*. HIV-2 infection among prostitutes working in The Gambia: association with serological evidence of genital ulcer diseases and with generalized lymphadenopathy. *AIDS* 1991;**5:**69–75.

[12]Pepin J, Morgan G, Dunn D, Gevao S, Mendy M, Gaye I *et al*. HIV-2-induced immunosuppression among asymptomatic West African prostitutes: evidence that HIV-2 is pathogenic, but less so than HIV-1. *AIDS* 1991;**5:**1165–72.

[13]Hawkes S, West B, Wilson S, Whittle H, Mabey D. Asymptomatic carriage of Haemophilus ducreyi confirmed by the polymerase chain reaction. *Genitourin Med* 1995;**71:**224–27.

[14]Ariyoshi K, Cham F, Berry N, Harding E, Sabally S, N'Gom PT *et al*. Diagnosis of HIV-1/2 dual infection using dilution analysis of type-specific antibody. *AIDS* 1998;**12:**2504–05.

[15]WHO. *Scaling Up Antiretroviral Therapy in Resource-Limited Settings: Treatment Guidelines for a Public Health Approach. 2003 Revision*. Geneva: WHO, 2003.

[16]Djomand G, Greenberg AE, Sassan-Morokro M, Tossou O, Diallo MO, Ekpini E *et al*. The epidemic of HIV/AIDS in Abidjan, Cote d'Ivoire: a review of data collected by Projet RETRO-CI from 1987 to 1993. *J Acquir Immune Defic Syndr Hum Retrovirol* 1995;**10:**358–65.

[17]Gilbert PB, McKeague IW, Eisen G, Mullins C, Gueye-NDiaye A, Mboup S *et al*. Comparison of HIV-1 and HIV-2 infectivity from a prospective cohort study in Senegal. *Stat Med* 2003;**22:**573–93.

[18]Poulsen AG, Aaby P, Jensen H, Dias F. Risk factors for HIV-2 seropositivity among older people in Guinea-Bissau. A search for the early history of HIV-2 infection. *Scand J Infect Dis* 2000;**32:**169–75.

[19]Marx PA, Alcabes PG, Drucker E. Serial human passage of simian immunodeficiency virus by unsterile injections and the emergence of epidemic human immunodeficiency virus in Africa. *Phil Trans R Soc London* 2001;**356:**911–20.