Study No. 1

HIV/AIDS prevalence among South African health workers and ambulatory and hospitalised patients

1. Terms of Reference

A recent study shows that South Africa has the largest number of people currently living with HIV/AIDS in the world. The *Nelson Mandela/HSRC Study of HIV/AIDS* (2002) reported that an estimated 4.5 million people are infected with HIV/AIDS in the country.

In this study (No 1), we investigated the prevalence of HIV/AIDS amongst South African health workers and patients in 2002 in order to assess the impact on, and inform recommendations for, the health care system.

The objective of this study was to ascertain the HIV/AIDS prevalence ratio amongst health workers and patients in the health care system, and to project morbidity due to AIDS among patients in public health facilities.
In this study we present:

- The demographic profile of patients served in the public and private health sectors;
- Reliability and validity of the study results;
- Findings on HIV prevalence amongst health workers;
- The HIV prevalence amongst ambulatory and hospitalised patients in public and private health care facilities;
- Morbidity among these patients; and
- Projection of the number of AIDS patients to use the health services in the next ten years.

Before presenting the results however, we discuss the issues around HIV testing.

1.1 Literature review on HIV testing

Tests to determine an individual's HIV status may be conducted on a range of body fluids including blood, plasma, urine and oral fluids. A brief review of the literature shows that it is appropriate to use oral fluid as a test substrate for HIV surveillance purposes. There is consensus that oral fluid testing is sensitive and specific enough to use for HIV surveillance purposes, whether among adults or children. Earlier problems with low sensitivity have been corrected by using specialised collection devices that concentrate and stabilise the salivary-associated immunoglogulins (Gallo, 1997). Modified EI and Western Blot assays have improved the sensitivities to between 97 per cent and 100 per cent, and specificities to between 98 per cent and 100 per cent, depending on the study. For example, the Oral Fluid Vironostika HIV-1 Microelisa System (Organon Teknika, Durham, NC) and the Orasure HIV-1 Western Blot Kit (Epitope Ince, Beaverton, OR) have provided the correct result of triggered appropriate follow-up testing in 3 569 (>99 per cent) of 3 570 cases (Gallo, 1997).

A study in the USA that evaluated a system using oral mucosal transudate for HIV-1 antibody screening followed with a confirmatory test to determine the accuracy of the HIV-1 antibody testing system, found that oral fluid testing is a highly accurate alternative to serum testing (Gallo, 1997).

A study to validate a method for oral fluid testing for HIV infection in children older than 12 months found that from 331 specimens, specificity and sensitivity of oral fluid testing compared with results on sera were both 100 per cent (297 of 297; 95 per cent CI 98.8 to 100 per cent) and 34 of 34 (95 per cent CI 89.7 to 100 per cent), respectively (Tess, 1996). The author concluded that:

> salivary testing provides an accurate and acceptable non-invasive method for assessing the HIV infection status of children born to infected mothers by using IgG antibody capture enzyme-linked immunosorbent assay alone with a strategy of duplicate retesting of reactive specimens.

In South Africa, investigators from the University of Pretoria compared tests of whole blood and saliva for HIV antibodies (anti-HIV) using a rapid test strip capillary flow immunoassay, and correlated the test strip results with blood specimen results obtained from routine diagnostic anti-HIV assays (Weber, 2000). Only two salivary test strip results tested false-negative, both from marasmic and severely dehydrated babies, while the other results were all in concordance. The authors concluded that:

> anti-HIV test strip methodology for whole blood and salivary specimens is rapid, reliable and easy to perform and interpret. Saliva specimens can be readily collected from any individual, and there is a reduction in hazard risk. Anti-HIV saliva testing using the test strip methodology is recommended for South Africa, particularly in high-risk situations such as the paediatric and forensic medicine settings.

There are a number of obvious advantages to collecting specimens for HIV testing by using a non-invasive specimen collection procedure, for example, there is greater safety and increased patient compliance. A recent study that aimed to evaluate youth preferences for rapid and innovative human immunodeficiency virus antibody tests found that an oral collection device with a rapid saliva test was the most highly preferred test method (Peralta, 2001).

There are ways of estimating AIDS cases without laboratory evidence. The method is described below.

1.2 Clinical AIDS case definitions

The Bangui case definition belongs to a group of instruments called clinical case definitions, used to measure AIDS in the absence of laboratory evidence. According to these definitions, a person is considered likely to have AIDS if he/she presents with certain clinical signs or conditions. Currently there are 29 such disease/signs (http://www.continuummagazine.org/what_is_AIDS_hiv.htm.). The CDC in Atlanta initiated the use of these definitions for the purpose of surveillance of AIDS worldwide.

The literature reviewed reveals that the case definitions are useable in diagnosing AIDS, especially where HIV testing is a standard procedure. Weniger et al. (1992) used the revised Caracas/PAHO case definition among patients in a Brazilian hospital, 110 of whom were HIV positive, and 135 HIV negative. Using the serological results as a standard, they found the major and minor symptoms to be highly predictive of AIDS.

There are currently six clinical case definitions used in different countries and settings. The first three definitions are used in countries with sophisticated laboratory facilities, while the last three are used where laboratory facilities are limited (PAHO/WHO, 2001). These are:

- CDC 1987;
- CDC/CD4;

- European;
- WHO surveillance (Bangui/WHO/Clinical);
- Expanded WHO surveillance (formerly Abidjan);
- Caracas/PAHO; and Revised Caracas/PAHO.

Each of the case definitions is described in more detail in Appendix 2.

Having examined all definitions for AIDS cases, we chose to use the WHO Bangui definition to measure the prevalence of AIDS in the absence of an HIV test. The World Health Organisation (WHO) designed this definition for surveillance purposes in Africa where diagnostic resources are limited. Simplicity of symptoms used allows for easy definition. In addition, it has been used successfully in Africa since 1980. (See Appendix 2 for more details on AIDS case definitions.)

1.3 Method

A detailed account of methodology in both the pilot study and national survey is provided in the Introduction (see pages 5–18) and in Appendix 3. Important issues of consent and ethics are also outlined in the Introduction.

2. Results

2.1 Demographic profile of patients

Table 7 presents findings on the demographic characteristics of the sample selected. This information is useful in understanding the patient population served by the public and private health care system.

In this part of the study, we surveyed 1 949 patients in all provinces. Of these, 86.9 per cent were in the public health sector and the remainder in the private health sector. Our sample consisted largely of females, youth and adults of reproductive age. Most of the patients were African, followed by coloureds. The majority spoke Nguni languages, followed by those speaking seSotho languages. The majority came from villages. They owned their dwelling as opposed to renting, and were more likely to have attained high school or more education. The respondents were more likely to be religious than not. They also were more likely to be unmarried (single, widows or separated) than not, and were more likely to live alone.

The public health sector has a significantly different patient profile from that of the private health sector. The public sector has a higher proportion of females, while the reverse is true for the private health sector. Public sector patients were also more likely to be youths (15–24 years), while the private sector patients were likely to be older (25 years or older). The patients using the public health sector were more likely to be unemployed, unmarried and live alone, while those using the private sector were more likely to be employed, married and live with someone.

The public sector served few whites – they tended to be seen in the private health sector – while Africans and coloureds were more likely to be served by the public health sector.

Although there were significant differences between the two health sectors in the demographic characteristics of patients they serve, there were no significant differences in the patients' educational levels, religiosity, housing situation and home language.

Table 7: Characteristics of patients of health facilities by sector of facility (public or private), South Africa, 2002, weighted data

		TOTAL	PUBLIC	PRIVATE	STRUCTURAL TEST public vs private
	n=	1949	1694	255	
Gender					p<0.001
Male	693	32.0	31.4	54.1	
Female	1256	68.0	68.6	45.9	
Age					p=0.243
Child (0 to 14 years old)	415	22.1	22.3	15.6	
Adult (15 to 49 years old)	1534	77.9	77.7	84.4	
Age					p=0.001
0 to 14 years old	415	22.1	22.3	15.6	
15 to 29 years old	731	41.4	41.9	23.9	
29 years old and more	803	36.5	35.8	60.5	
Province of facility					p=0.016
Eastern Cape	346	24.9	25.2	13.2	
Free State	173	7.9	8.0	4.2	
Gauteng	372	14.9	13.3	65.5	
KwaZulu-Natal	265	16.6	16.9	7.1	
Mpumalanga	109	3.0	3.0	2.8	
Northern Province (Limpopo)	188	8.5	8.7	0.0	
North West	165	8.5	8.6	4.4	
Northern Cape	128	2.9	2.9	2.8	
Western Cape	203	12.9	13.3	0.0	
Province where respondents live					p<0.001
Eastern Cape	363	25.3	25.6	16.9	
Free State	164	7.7	7.8	4.4	
Gauteng 340	14.4	13.3	51.4		
KwaZulu-Natal	270	16.4	16.7	6.9	
Mpumalanga	112	3.1	3.1	5.7	
Northern Province (Limpopo)	199	8.8	8.9	4.7	

		TOTAL	PUBLIC	PRIVATE	STRUCTURAL TEST public vs private
North West	173	8.5	8.6	6.7	
Northern Cape	124	2.7	2.7	2.6	
Western Cape	204	12.9	13.3	0.5	
Race					p=0.001
African	1536	80.7	80.8	77.9	
Indian	34	1.7	1.6	4.4	
Coloured	305	15.8	16.1	8.0	
White	74	1.8	1.6	9.7	
Home language					p=0.862
Afrikaans	332	14.9	14.9	13.7	
English 84	4.2	4.1	7.2		
Nguni languages	835	49.7	49.8	44.7	
Sotho languages	590	25.5	25.4	28.2	
Other languages	108	5.8	5.7	6.1	
Type of place where living					p=0.006
Village	992	52.0	52.8	26.0	
Town	724	35.2	34.7	52.2	
City	233	12.8	12.5	21.8	
Owned or rented dwelling					p=0.097
Own	1576	76.3	76.3	78.5	
Rent	317	19.5	19.5	20.9	
Other	56	4.2	4.3	0.6	
Education level					p=0.862
Less than high school	871	41.1	41.1	40.0	
High school or more	1078	58.9	58.9	60.0	
Attendance at religious services					p=0.189
Regularly (Once a week)	1067	58.4	58.7	50.3	
Often (Once or twice a month)	443	19.2	19.1	21.8	
Seldom / Never	439	22.4	22.2	27.9	

		TOTAL	PUBLIC	PRIVATE	STRUCTURAL TEST public vs private
Employment *					p<0.001
Employed	498	29.0	27.9	63.6	
Unemployed – looking for job	498	36.7	37.2	22.4	
Unemployed – not looking for job	538	34.3	34.9	14.0	
Marital status *					p=0.032
Married (civil and/ or traditional)	412	22.1	21.6	38.6	
Others	1122	77.9	78.4	61.4	
Couple situation *					p=0.001
Living with spouse/ sexual partner	603	33.3	32.7	51.4	
Living alone	931	66.7	67.3	48.6	
Marital status *					p=0.036
Married – more than one wife	26	1.0	1.0	2.0	
Married – one wife	386	21.1	20.6	36.7	
Not married	1122	77.9	78.	4 61.4	

On all patient population (n=1949)
** On adult patient population (n=1534)*

2.2 Reliability and validity of study results

In this section we present:

- Response rates;
- Validity of HIV prevalence estimates;
- Validity of questionnaires; and
- Validity of HIV testing.

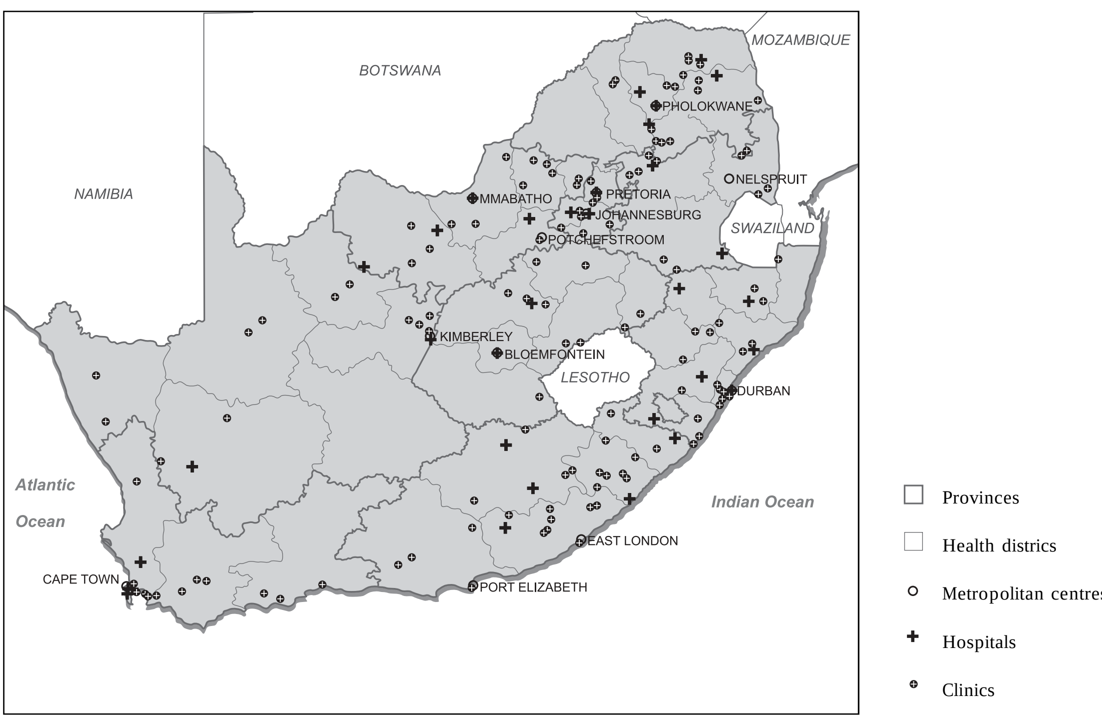
2.2.1 Response rates

Amongst the 222 health facilities that were selected, those that refused to participate were substituted by other equivalent health facilities. The different response rates on various items are indicated in the respective sections of the report.

Figure 5 shows the location of most of the health facilities.

The geographic coordinates for three health facilities (i.e. St Augustine hospital, Hibiscus hospital and Groblersdal hospital) could not be obtained from the DoH's health facility database.

Figure 5: Realised sample of selected health facilities, South Africa 2002



2.2.2 Validity of HIV prevalence estimates

The estimates of HIV prevalence take into consideration the full complexity of the sample by using the Stata procedure Svymean, and include the standard errors (SE), the CI 95% and the coefficient of relative variation (CVr). The HIV prevalence is a ratio. A ratio estimate is a biased estimate. As a rule of thumb the Kish guideline of CVr of <20 per cent is used as a reference threshold to determine the validity of prevalence estimates (Kish, 1965). An estimate is not precise if the confidence interval is too wide. Consequently, if a CVr value is relatively 'large', then the estimate has low reliability.

Based on this method, which is considered the most rigorous, the estimates of HIV prevalence among health workers should be considered valid for public sector health workers and less so for private sector health workers. This is because of the small sample size in that group. For professional health workers, male and from 36 to 45 years old, the imprecision of estimates are of substantive importance and are at the statistical borderline. For this reason, the results on these latter subgroups should be treated with caution, and this is why CVrs were also supplied to the reader. Finally, very high CVrs in some subgroups (health workers in the private sector of 46 years and older and of race groups other than African) clearly indicate that the survey was not able to produce valid estimations of prevalence due to small sample sizes.

The CVrs should not be examined in isolation of the design effect (Deff). We calculated Deff, that is, the loss of effectiveness when using cluster sampling instead of employing random sampling procedure. Deff is generally used to determine the desired sample size or CIs necessary to estimate reliability of the population parameters. If a study is well designed the Deffs usually range between 1 and 3, but they can be much higher (Schackman, 2001). The smaller the value, the more reliable the sample estimate will be. In this study the design effects for HIV prevalence among health workers and patients (adults and children) are listed in Tables 8 and 9. Due to insufficient funds, we could not sample health workers and patients in large numbers to test them for HIV status and hence some of the findings cannot be relied upon. These are the estimates of HIV prevalence in the private sector patient population, amongst coloured, Indian and white patient population groups, amongst male patients, patients in the North West, as well as amongst children.

Table 8: HIV prevalence and response rates among health workers by socio-demographic and health facilities' characteristics, coefficient of variation and the design effect

	COUNT	n	RESPONSE RATE	HIV PREVALENCE (%)	SE	CI 95%	CVr	Deft	Deff
Total	721	595	82.5%	**15.7**	1.915	(12.24,19.88)	0.12	1.28	1.65
Sector of facility									
Public	625	512	81.9%	**16.3**	2.072	(12.55,20.84)	0.13	1.45	2.12
Type of facility									
Primary health care facility/clinic	305	264	86.6%	**17.5**	2.736	(12.72,23.7)	0.16	3.49	12.18
Public Hospitals	320	248	77.5%	**15.9**	2.432	(11.2,21.96)	0.15	2.08	4.34
Province of facility									
Free State	172	142	82.6%	**9.6**	1.389	(7.061,12.91)	0.14	2.08	4.31
KwaZulu-Natal	284	231	81.3%	**17.1**	3.055	(11.69,24.26)	0.18	2.86	8.20
Mpumalanga	109	79	72.5%	**19.6**	3.571	(12.99,28.58)	0.18	8.84	78.12
North West	156	143	91.7%	**19.7**	2.692	(14.61,25.93)	0.14	3.11	9.65
Occupation status									
Professional	440	349	79.3%	**13.7**	3.215	(8.467,21.46)	0.23	2.66	7.07
Non-professional	281	246	87.5%	**20.3**	3.494	(14.2,28.14)	0.17	3.56	12.69
Gender									
Male	120	97	80.8%	**18.9**	4.77	(11.05,30.48)	0.25	8.07	65.12
Female	601	498	82.9%	**15.3**	2.132	(11.51,20.04)	0.14	1.51	2.29
Age									
18 to 35 years old	254	203	79.9%	**20.0**	3.378	(14.09,27.63)	0.17	3.28	10.76
36 to 45 years old	263	221	84.0%	**16.6**	3.634	(10.53,25.13)	0.22	3.74	14.01
Race group									
African	577	473	82.0%	**21.1**	2.287	(16.91,26.01)	0.11	1.59	2.54

Abbreviations in this table and others in this report:
Count = Total size of the sample,
n = number of tested respondents in the sample,
SE = standard error of the prevalence ratio,
CI 95 = confidence interval (95%),
CVr = coefficient of variation of prevalence ratio,
Deft = design factor (square root of Deff), and
Deff = Design effect.

Table 9: HIV prevalence and response rates among patients (adults and children) of health facilities, by socio-demographic and health facilities' characteristics, coefficient of variation and the design effect

	COUNT	n	RESPONSE RATE	HIV PREVALENCE (%)	SE	CI 95%	CVr	Deft	Deff
Total	712	634	89.0%	**28.0**	2.933	(22.56,34.21)	0.10	1.63	2.66
Sector of facility									
Public	652	581	89.1%	**27.9**	2.975	(22.37,34.19)	0.11	1.66	2.75
Type of facility									
PHC facility/clinic	375	355	94.7%	**25.7**	3.198	(19.82,32.51)	0.12	1.95	3.80
Public hospital	277	226	81.6%	**46.2**	4.262	(37.93,54.73)	0.09	5.00	24.99
Province of facility									
Free State	173	166	96.0%	**37.8**	3.837	(30.52,45.68)	0.10	3.36	11.31
KwaZulu-Natal	265	225	84.9%	**23.7**	4.642	(15.74,34.15)	0.20	3.65	13.33
Mpumalanga	109	86	78.9%	**29.4**	4.633	(21.12,39.41)	0.16	7.39	54.63
North West	165	157	95.2%	**26.3**	6.853	(14.96,41.86)	0.26	7.12	50.69
Gender									
Male	245	213	86.9%	**21.7**	4.826	(13.56,32.8)	0.22	4.77	22.76
Female	467	421	90.1%	**30.9**	3.033	(25.19,37.23)	0.10	1.84	3.37
Age									
Youths (15–24)	189	181	95.8%	**25.6**	4.596	(17.5,35.73)	0.18	4.04	16.30
Adults (25–49)	390	368	94.4%	**36.2**	4.56	(27.71,45.69)	0.13	2.99	8.95
Race									
African	659	591	89.7%	**28.9**	3.059	(23.19,35.33)	0.11	1.72	2.94

The detailed results are presented below.

2.2.3 Validity of questionnaires

Validity of a questionnaire refers to the extent to which it measures what it intends to measure, i.e. variables and items on the questionnaire accurately measure information on exposures, outcomes of interest, demographic, behavioural variables etc. A valid questionnaire is free of bias.

To ensure validity of the questionnaire, we integrated information carefully from various sources from previously tested questions. We used Stats SA variables on demographics and standard behavioural variables from Family Health International, an organisation with extensive international experience in HIV/AIDS surveys. In both instances we made the necessary adaptations for the purposes of our study.

2.2.4 Validity of HIV testing

The validity of HIV testing is described in Appendix 5.

The results presented below are based on data collected from health personnel employed in the public and private sectors in clinics and hospitals located in the Free State, KwaZulu-Natal, Mpumalanga and North West provinces. Table 10 presents the overall HIV prevalence among 595 health workers, of whom 512 were working in the public sector and only 83 in the private sector. The figures for the private sector are based on numbers that are too small to give meaningful statistics; hence only the overall figure is reported. The rest of the private sector details are included in the statistics for all health workers and are not reported separately.

Table 10: HIV prevalence among health workers employed in health facilities located in four provinces, 2002

	n	% HIV+ ALL WORKERS	n	% HIV+ IN THE PUBLIC SECTOR
Total	595	15.7	512	16.3
SE		1.915		2.072
CI 95%		(12.2, 19.9)		(12.5, 20.8)

Table 11 shows HIV prevalence among health workers by type of health facility. The results show that an estimated 16.3 per cent of all public sector health workers in the four provinces were HIV positive. This figure is not significantly different between those working in primary health care facilities and those in state hospitals.

Table 12 shows HIV prevalence ratios amongst health workers categorised by professional status. The prevalence appears to be higher among non-professionals than professionals. However, the differences are not large enough to reach statistical significance.

Table 11: HIV prevalence among health workers employed in health facilities located in four provinces by type of facility, 2002

	n	% HIV+	p
Type of facility			0.60
PHC facility/clinic	264	17.5	
SE		2.736	
CI 95%		(12.7, 23.7)	
State academic/state	248	15.9	
SE		2.432	
CI 95%		(11.2, 21.9)	
Public sector (combined)	512	16.3	
SE		2.072	
CI 95%		(12.5, 20.8)	

Table 12: HIV prevalence amongst health workers employed in health facilities located in four provinces by professional status, 2002

	n	% HIV+ ALL HEALTH WORKERS	p	n	% HIV+ PUBLIC SECTOR	p
Professional status			0.28			0.40
Professional	349	13.7		303	14.4	
SE		3.215			3.71	
CI 95%		(8.4, 21.4)			(8.5, 23.5)	
Non-Professional	246	20.3		209	20.3	
SE		3.494			3.761	
CI 95%		(14.2, 28.1)			(13.8, 28.8)	

Table 13 shows HIV prevalence among health workers by various demographic characteristics. When the prevalence ratios are examined by the sex and age of health workers, the observed differences are not statistically significant. When the prevalence ratios are examined by race of all health workers, major differences were observed. African health workers had a much higher HIV prevalence than all other race groups. Caution needs to be taken in interpreting these results because the figures amongst all other race groups are too small to yield meaningful results.

Table 13: HIV prevalence amongst health workers employed in four provinces by demographic characteristics, 2002

		n	% HIV+ ALL HEALTH WORKERS	p	n	% HIV+ PUBLIC SECTOR	p
Sex of health worker				0.49			0.85
Male		97	18.9		76	17.2	
	SE		4.77			4.801	
	CI 95%		(11, 30.5)			(9.5, 29.1)	
Female		498	15.3		436	16.2	
	SE		2.132			2.233	
	CI 95%		(11.5, 20)			(12.2, 21.1)	
Age				0.48			0.33
18–35		203	20.0		168	22.4	
	SE		3.378			3.683	
	CI 95%		(14.1, 27.6)			(15.9, 30.6)	
36–45		221	16.6		193	15.2	
	SE		3.634			3.782	
	CI 95%		(10.5, 25.1)			(9, 24.3)	
46 years old or more		171	10.0		151	11.1	
	SE		5.282			6.016	
	CI 95%		(3.3, 26.4)			(3.6, 29.7)	
Race group							
African		473	21.1		419	20.9	
			2.287			2.477	
			(16.9, 26)			(16.4, 26.3)	
Education level				0.60			0.63
Matric and below		285	17.3		240	18.0	
	SE		3.075			3.295	
	CI 95%		(12, 24.3)			(12.4, 25.5)	
Above matric		310	14.6		272	15.1	
	SE		3.189			3.639	
	CI 95%		(9.3, 22.1)			(9.2, 23.9)	

	n	% HIV+ ALL HEALTH WORKERS	p	n	% HIV+ PUBLIC SECTOR	p
Marital status			0.008			0.001
Married (civil and/or traditional)	301	11.8		252	11.5	
SE		2.229			2.484	
CI 95%		(8.1, 17.1)			(7.3, 17.4)	
Not married	294	20.0		260	21.5	
SE		2.861			2.784	
CI 95%		(14.9, 26.3)			(16.4, 27.5)	

Table 13 shows that amongst health workers education is not significantly related to HIV prevalence, but marital status was strongly related to HIV status. Health workers who were unmarried were more likely to be HIV positive than those who were married.

Several demographic variables were included in a logistic regression model to examine their relationship to HIV status, after controlling for other variables. We found the following results: race was significantly related to HIV status – health workers who were Africans were more likely than workers of other combined race groups to be HIV positive (OR=6.6, p<0.001). Age was also related to HIV status – we found that unmarried health workers were more likely to be HIV positive than married health workers (OR=1.7, p<0.01).

2.5 HIV prevalence amongst patients attending public and private health facilities

Another key objective was to estimate the HIV prevalence among patients and the number of persons with HIV/AIDS utilising public health services in South Africa and to determine the demographic profile of these patients.

The results below, based on testing oral fluids of 634 patients for HIV antibodies, show that the overall HIV prevalence in public and private health care facilities located in four South African provinces and measured in PHC, clinics and hospitals, was 28 per cent (CI 95% was 22.5, 34.2 per cent).

Table 14 presents findings of HIV prevalence amongst patients by type of health care facility. The results show that the burden of HIV is highest in the public health facilities, followed by private hospitals and least on primary health care facilities. Primary health care patients are ambulatory, while hospital patients are admitted to either paediatric wards or medical wards of public or private facilities.

Table 14: HIV prevalence amongst ambulatory and in-patients hospitalised in public and private health facilities in four provinces, 2002

	n	% HIV+ ALL PATIENTS (222)	p
Total	634	28.0	
SE		2.933	
CI 95%		(22.5,34.2)	
Type of facility			<0.0001
PHC facility/clinic	355	25.7	
SE		3.198	
CI 95%		(19.8, 32.5)	
Private hospital	53	36.6	
SE		8.8	
CI 95%		(21.3, 55.1)	
State academic/state	226	46.2	
SE		4.262	
CI 95%		(37.9, 54.7)	

The results were further analysed by province where these patients were served. While Table 15 shows that the burden of HIV/AIDS was highest in the Free State, followed by Mpumalanga, then North West and KwaZulu-Natal, these differences are not statistically significant. The table also presents the same results for patients in the public health sector, excluding the private sector. The results are similar to those for all patients.

Table 16 presents HIV prevalence amongst patients by sex and age, which includes public and private sector patients served in the four provinces. The results show that male patients were more likely than female patients to be HIV positive, although the differences were not large enough to reach statistical significance. This finding holds for all patients.

The results also show that there is a positive relationship between age and HIV status among the ambulatory and inpatients. The HIV prevalence among patients increased with age. Those aged 2 to 14 years have the lowest prevalence, followed by the youth aged 15 to 24 years, and then those aged 25 to 49 years. This relationship is statistically significant.

Due to small numbers, the prevalence ratios for races other than African are not reliable, and hence are not reported. For Africans, the rates are more likely to reflect the true value.

Table 15: HIV prevalence amongst patients attending public and private health facilities by provinces, 2002

	% HIV+ ALL PATIENTS		p	% HIV+ PUBLIC SECTOR		p
Province of facility			0.18			0.22
Free State	166	37.8		153	37.4	
SE		3.837			3.893	
CI 95%		(30.5, 45.7)			(30, 45.4)	
KwaZulu-Natal	225	23.7		211	23.9	
SE		4.642			4.688	
CI 95%		(15.7, 34.1)			(15.8, 34.4)	
Mpumalanga	86	29.4		73	29.0	
SE		4.633			4.745	
CI 95%		(21.1, 39.4)			(20.5, 39.2)	
North West	157	26.3		144	26.1	
SE		6.853			6.972	
CI 95%		(14.9, 41.9)			(14.7, 42.1)	

Table 16: Prevalence of HIV amongst ambulatory and hospitalised patients in four provinces by sex, age and race, 2002

	n	% HIV+ ALL PATIENTS	p	n	% HIV+ PUBLIC SECTOR	p
Total	634	28.0		581	27.9	
Gender			0.09			0.09
Male	213	21.7		179	21.2	
SE		4.826			4.948	
CI 95%		(13.5, 32.8)			(12.9, 32.7)	
Female	421	30.9		402	30.9	
SE		3.033			3.054	
CI 95%		(25.2, 37.2)			(25.1, 37.3)	
Age			0.047			0.050
0–14	85	11.3		82	11.3	
SE		6.593			6.61	
CI 95%		(3.2, 32.5)			(3.2, 32.6)	

		n	% HIV+ ALL PATIENTS	p	n	% HIV+ PUBLIC SECTOR	p
15–24		181	25.6		172	25.6	
	SE		4.596			4.617	
	CI 95%		(17.5, 35.7)			(17.5, 35.8)	
25–49		368	36.2		327	36.1	
	SE		4.56			4.672	
	CI 95%		(27.7, 45.7)			(27.4, 45.8)	
Race							
African		591	28.9		545	28.7	
	SE		3.059			3.098	
	CI 95%		(23.2, 35.3)			(22.9, 35.3)	

Table 17 presents HIV prevalence among ambulatory and hospitalised patients by marital status. Unmarried patients were more likely than married patients to be HIV positive. However the relationship was not statistically significant.

Table 17: HIV prevalence among ambulatory and hospitalised patients in four provinces by marital status, 2002

		n	% HIV+ ALL PATIENTS	p	n	% HIV+ PUBLIC SECTOR	p
Marital status				0.15			0.14
Married (civil and/ or traditional)		143	25.8		118	25.3	
	SE		4.755			4.912	
	CI 95%		(17.4, 36.4)			(16.7, 36.3)	
Not married		406	33.4		381	33.4	
	SE		3.474			3.511	
	CI 95%		(26.9, 40.6)			(26.8, 40.7)	

2.6 Discussion of HIV prevalence amongst health workers

The observed HIV prevalence of 15.7 per cent amongst health workers aged 18 years and older is very high. This is not surprising because the HIV prevalence amongst South Africans of reproductive age (15-49 years), was found to be 15.6 per cent (Shisana et al., 2002). As members of that community, these health workers will reflect the level of HIV prevalence in that community.

However, such high HIV prevalence amongst health workers has serious implications for the health system. Health workers who are HIV positive should be placed in work situations where they are less likely to contract TB, given that TB is a common opportunistic infection in people living with HIV/AIDS. A vigorous VCT service targeted at health workers is necessary to afford them the opportunity to know their HIV status and then to be reassigned to work with non-TB patients.

HIV-infected health workers are less likely to transmit HIV to their patients. In international literature there are extremely few cases of infected health workers who have transmitted HIV to their patients. These cases are that of a Florida dentist who infected six patients, and a French orthopaedic surgeon who infected one patient (Bartlett, 1997).

Some governments, such as in Australia, have developed policies to prevent nosocomial infection from health workers to patients by requiring that all public health workers who perform exposure-prone procedures know their blood-borne virus status, including HIV, and that such health workers do not perform exposure-prone procedures. (See: http://www.health.nsw.gov.au/fcsd/rmc/cib/circulars/1999/cir99-88.pdf). Exposure-prone procedures as defined in the guidelines refer to a sub-set of invasive procedures that involve the possibility of the skin of health care workers (usually a finger or thumb) coming into contact with sharp surgical instruments and needles or sharp tissues (such as teeth). Procedures that do not have these features are considered less risky. Compliance with infection control is required as a means to prevent infection from health worker to patients.

The United Kingdom has established an advisory committee to inform the government on how to manage health workers who have blood borne diseases, including those living with HIV/AIDS. The committee has published a paper for comment that includes the following key principles:

- Keeping confidentiality of the HIV status of health workers;
- Criteria for notifying a patient of the risk of having been exposed to HIV from a health worker, recognising that the risk of transmission is low; and
- Care of the health care worker.
  (See: http://www.scotland.gov.uk/library5/health/ahhc-05.asp#b8)

Given the low risk of transmission from health worker to patients, Bartlett (1997) recommends that the focus should not be on the health worker, except if there is proof that the health workers have transmitted HIV to a patient. The focus should rather be on strengthening infection control measures. The infection control measures in South African PHC facilities seem to be inadequate. We will see later in this report that nearly a third of these facilities do not stock sterilising equipment; and 20 per cent of private sector health facilities, 10.7 per cent of PHC facilities and 4.9 per cent of public hospitals, reported never to stock protective clothing and gloves. Furthermore, we will also see that nearly 17 per cent of health workers in the private health sector do not stock disinfectants (Jik), and only 35.7 per cent of health workers have had training in universal precautions against infection. The extent to which the lack of infection control contributes to HIV infections from health worker to patient, or more likely from patient to patient, in South

Africa is unknown and needs to be investigated. We recommend that the South African Ministry of Health establishes a committee to advise it on the development of policy guidelines for health facilities on the management of health workers who are HIV positive, and also to ensure training in universal precautions against infection.

2.7 Discussion of HIV prevalence among patients

In this study we found the prevalence of HIV among patients treated in health care facilities to be 28 per cent; the percentage among PHC centers, including district hospitals, was 25.7 per cent; and the figure was much higher in the public hospitals where 46.2 per cent of patients were HIV positive. In other parts of the world, studies have shown that between 39–70 per cent of beds in several hospitals in Thailand, Uganda, Congo, Rwanda, Burundi and Nairobi were occupied by persons who were HIV positive (World Bank, 1997). This information is used as evidence that there is a possible 'crowding out' of HIV negative people by HIV positive patients.

The results obtained in this study suggest that the burden of care for PHC facilities as well as public hospitals is substantial.

Table 18 presents the distribution of patients who experienced major signs and symptoms of HIV/AIDS. The small sample size, particularly when looking at sub-groups, makes the significance of differences between groups difficult to determine.

The finding that almost half of the patients admitted to hospital are HIV-infected demonstrates the massive increase in the burden placed on health care facilities. When one considers that there has not been a significant increase in the number of public sector hospital beds provided over the last decade, the implications of this study are that almost half the number of hospital beds are now available to patients not infected with HIV.

The prevalence of HIV found among patients is compatible with other recent reports. In a study of hospitalised patients in a Durban academic hospital in 1998, 54 per cent of adult admissions (Colvin et al., 2001) and 60 per cent of paediatric admissions (Pillay, 2001) were HIV positive.

It is interesting to contrast the age distribution of hospitalised cases with the age distribution found in community-based HIV prevalence studies. In the latter, the peak prevalence is in the 20 to 29 year age group, whereas the age group with the highest prevalence among hospitalised patients is older. This is in keeping with the estimated nine-year latency period between infection and HIV-related disease. In other words, if the peak HIV prevalence is among 20 to 29 year olds, then we would expect HIV-related disease to peak about nine years later.

The finding that the lowest HIV prevalence was among those attending PHC clinics is not surprising as this population is not as sick as hospitalised patients, who, by definition, are sicker. As AIDS is a terminal disease in the absence of antiretrovirals, it is to be expected that HIV prevalence will be higher among hospitalised patients than among ambulatory patients.

3. Estimating AIDS Cases in Health Facilities

3.1 Morbidity of patients attributable to AIDS

AIDS morbidity among patients in health facilities was estimated through the use of a questionnaire developed following major and minor signs of AIDS as defined in the Bangui AIDS case definition. This questionnaire was administered to adults and children. For children below the age of 15, mothers/guardians or persons who accompanied them to health centres on the day of the survey gave responses on their behalf. It is common knowledge that ascertaining diseases or exposures through questionnaires is inevitably subject to errors. This means that the likelihood of misclassification of disease or exposure status is highly likely. The Bangui scale was used with this in mind, and hence it was validated against the HIV test as a reference.

Caution must be exercised in interpreting the results because some of the patients who are HIV positive are asymptomatic and some of those who have relevant major signs and minor symptoms may also not be HIV positive. We attempted to develop an AIDS case definition for surveillance purposes by selecting patients who are HIV positive and also have two major signs and one minor sign of AIDS based on the Bangui case definition.

3.1.1 Measuring HIV/AIDS status using the Bangui case definition

To measure the presence or absence of AIDS within the sample of patients, we created two indicator variables, namely AIDS presence and AIDS absence from a combination of major and minor signs as defined in the Bangui case definition. This case definition is described in paragraph 1.2 of this study and in Appendix 2.

*Table 18: Distribution of signs and symptoms of AIDS, South Africa, 2002**

	n**	TOTAL %	PHC FACILITY/ CLINIC %	PRIVATE HOSPITAL %	STATE ACADEMIC / STATE %
Do you have genital warts?					
Yes	19	1.6	1.4	1.1	1.8
No	1 203	98.4	98.6	98.9	98.2
In the last 3 months, have you had diarrhoea that lasted for more than three days?					
Yes	188	15.1	11.3	8.7	22.6
No	1 053	84.9	88.7	91.3	77.4
In the last 3 months did you have fever for more than one month?					
Yes	234	18.9	13.4	15.2	28.3
No	1 006	81.1	86.6	84.8	71.7

	n*	TOTAL %	PHC FACILITY/ CLINIC %	PRIVATE HOSPITAL %	STATE ACADEMIC / STATE %
Have you had white sores in your mouth over the last three months?					
Yes	98	7.9	4.4	5.5	13.9
No	1 139	92.1	95.6	94.5	86.1
Have you had sores on your skin over the last three months?					
Yes	98	7.9	7.7	6.5	8.5
No	1 142	92.1	92.3	93.5	91.5
Do you have swollen lymph nodes in your neck, under your arms or in the groin?					
Yes	81	6.5	6.0	2.2	8.3
No	1 157	93.5	94.0	97.8	91.7
Have you been treated for pneumonia more than once during the last year?					
Yes	75	6.0	3.0	8.7	10.3
No	1 168	94.0	97.0	91.3	89.7
Do you have difficulty swallowing solid foods, compared to liquids?					
Yes	98	7.9	4.3	8.7	13.4
No	1 146	92.1	95.7	91.3	86.6
Do you have recurrent headaches throughout the day and night?					
Yes	376	31.2	29.0	38.9	33.1
No	829	68.8	71.0	61.1	66.9
Have you had shingles over the last 12 months?					
Yes	35	2.8	2.4	0.0	4.0
No	1 207	97.2	97.6	100.0	96.0
Have you had a persistent cough for one month or more?					
Yes	151	14.4	10.7	8.5	22.6
No	900	85.6	89.3	91.5	77.4

** On adult patient population that answer to the question*

We then used these variables to classify diseased and non-diseased persons and determine prevalence. This AIDS prevalence is given in Table 19 below.

Table 19: Prevalence of AIDS according to the Bangui scale for all adults and children in weighted and unweighted samples

UNWEIGHTED SAMPLE	PREVALENCE IN %	CI 95%	WEIGHTED SAMPLE	PREVALENCE IN %	CI 95%
All respondents	16.2	14, 2	All respondents	9.1	9, 9.3
Adults	16.0	13, 2	Adults	9.0	9, 9.2
Children	18.0	26, 10	Children	11.0	11,11.4
Total = 634			Total n= 153 325		

The Bangui case definition yielded reasonable prevalence (16.3 per cent) for both unweighted and weighted combined samples, and 16 per cent for weighted and unweighted adult only samples. All four sample sizes were big as seen from the precision of all four estimates.

The observed prevalence for both weighted and unweighted children's samples is numerically high, but that of the unweighted sample is not precise due to a small sample size. Estimates for the weighted sample were more precise because weighting the data tends to inflate the sample size.

3.1.2 Assessing the validity of the Bangui scale

Since we used the Bangui scale for screening purposes, it became necessary to contrast the computed statistics with the HIV test. For this purpose we computed sensitivity, specificity and predictive values of the test.

These terms are described briefly below:
- *Sensitivity*. The ability of the test to identify correctly those who have the disease; and
- *Specificity*. The ability of the test to identify correctly those who do not have the disease (Szklo & Nieto, 2000).

For diagnostic purposes we enquired further into the probability that a patient who tested positive to the Bangui test, actually has the disease (positive predictive value of the test (PPV+). To answer this question we calculated the proportion of patients who tested positive and truly have the disease, and the proportion of respondents who tested negative and are truly free of the disease (negative predictive value of the test).
We did this for all respondents combined, and for adults and children separately:
- *Positive predictive value* (PV+): The proportion of true positives among individuals who test positive; and
- *Negative predictive value* (PV-): The proportion of true negatives among individuals who test negative

Sensitivity, specificity and predictive values as used here are indices of validity of the Bangui test. Since this is the very first use of the test, it became necessary to test its validity rigorously. This we did by computing the indices of validity namely, sensitivity and specificity and predictive values. These estimates are given in Tables 20–26.

Table 20: Using a Bangui case definition and HIV test for all respondents (adults and children based on unweighted data)

HIV TEST RESULT	BANGUI SCALE AIDS PRESENT	BANGUI SCALE AIDS ABSENT	TOTAL
Positive	64 (10.1%)	158 (24.9%)	222 (35.0%)
Negative	39 (6.2%)	373 (58.8%)	412(65.0 %)
Total	103 (16.3%)	531 (83.7%)	634 (100%)

Prevalence: 103/634 = 16.2 per cent.
Sensitivity = 64/103 = 62 per cent, (CI 50, 74). The wider confidence intervals indicate reduced the precision of this statistic.
Specificity = 373/531 = 70 per cent (CI 65,74), a relatively narrow confidence interval indicated a more precise estimate. However in both estimates, the test missed 38 per cent and 30 per cent cases.
PV+ = 64/ 222 = 29 per cent
PV- = 373/412 = 91 per cent.

Table 21: Using a Bangui case definition and HIV test results for the combined sample (adults and children based on weighted data)

HIV TEST RESULT	BANGUI SCALE AIDS PRESENT	BANGUI SCALE AIDS ABSENT	TOTAL
Positive	6 922 (4.5%)	360 359 (23.5%)	42 957(28.0%)
Negative	7 085 (4.6%)	103 283 (67.4%)	110 368 (72.0%)
Total	14 007 (9.1%)	139 318 (90.9%)	153 325 (100%)

Prevalence: 14 007/153 325 = 9.1 per cent.
Sensitivity = 6922/14007 = 49 per cent (CI 95% 48,50)
Specificity = 103283/139318 = 74 per cent (CI 95% 74, 74.3)
PV+ = 6922/42957 = 16 per cent
PV- = 103283 / 110368 = 94 per cent.

The Bangui test performed better with an unweighted sample. With the weighted sample, it missed approximately 50 per cent of cases and about 26 per cent of non-cases. However, the estimates are more precise as seen from their narrow confidence intervals.

Similarly, predictive values for the unweighted sample are better when compared with those of the weighted sample (29 per cent vs 16 per cent).

Predictive values are normally interpreted within the context of prevalence and specificity, rather than sensitivity. The moderately high prevalence of 16.3 per cent and 9.1 per cent for unweighted and weighted samples respectively, and specificity of 70 per cent and 74 per cent for unweighted and weighted samples respectively, show that predictive values are acceptable. Hence, the Bangui scale has been used productively and efficiently within this facility-based population.

We also tested the validity of the Bangui scale separately for adults and for children in both weighted and unweighted samples. Table 22 provides these results.

Table 22: Sensitivity, specificity, and predictive values of the adult sample, unweighted

HIV TEST RESULT	BANGUI SCALE AIDS PRESENT	BANGUI SCALE AIDS ABSENT	TOTAL
Positive	61 (11.1%)	154 (28.1%)	215 (39.2%)
Negative	27 (4.9%)	307 (55.9%)	334 (60.8%)
Total	88 (16%)	461 (84%)	549 (100%)

Prevalence: 88/549 = 16.3 per cent (CI 95% 13, 19)
Sensitivity: 61/88 = 69.3 per cent (CI 95% 58, 81)
Specificity: 307/ 461 = 67 per cent (CI 95% 62, 72)
PV+: 61/215 = 28 per cent
PV-: 307/334 = 92 per cent.

For unweighted adult data, the Bangui scale had better sensitivity, specificity and positive predictive values, although the former two statistics had lower precision as seen from the wider confidence intervals (58.81 and 62.72).

Table 23: Sensitivity, specificity and predictive values of the adult sample, weighted

HIV TEST RESULT	BANGUI SCALE AIDS PRESENT	BANGUI SCALE AIDS ABSENT	TOTAL
Positive	6 584 (5.2%)	33 239 (26.5%)	39 823 (31.7%)
Negative	4 510 (3.6%)	81 210 (64.7%)	85 720 (68.3%)
Total	11 094	114 449 (91.2%)	125 543 (100%)

Prevalence: 11094/125543 = 9 per cent (CI 95% 9, 9.7)
Sensitivity: 6584/11094 = 59.3 per cent (CI 95% 58,60)
Specificity: 81210/114449 = 71 per cent (CI 95% 71, 71.3)
PV+: 6584/39823 = 17 per cent
PV-: 81210/85720 = 95 per cent

Similarly within the sub-sample of adults, the Bangui scale was better able to identify accurately diseased people within the unweighted than the weighted sample (69.3 per cent vs 59.3 per cent).

Table 24: Sensitivity, specificity, predictive values for children's sample, unweighted

HIV TEST RESULT	BANGUI SCALE AIDS PRESENT	BANGUI SCALE AIDS ABSENT	TOTAL
Positive	3 (3.5%)	4 (4.7%)	7 (8.3%)
Negative	12 (14.1%)	66 (77.6%)	78 (91.7%)
Total	15 (17.6%)	70 (82.4%)	85 (100%)

Prevalence: 15/85 = 18 per cent (CI 95% 10, 26)
Sensitivity: 3/15 = 20 per cent (CI 95% 0, 65)
Specificity: 66/70 = 94 per cent (CI 95% 88,100)
PV+: 3/7 = 45 per cent
PV-: 66/78 = 85 per cent

The sensitivity of 20 per cent is very low. This may be due to the inherent weaknesses of the Bangui scale as explained earlier. Specificity of 94 per cent is good, which means the scale was better able to accurately classify non-cases. The positive predictive value of 45 per cent is acceptable if one considers 18 per cent prevalence and a specificity of 94 per cent.

Table 25: Sensitivity, specificity and predictive values of children's sample, weighted

HIV TEST RESULT	BANGUI SCALE AIDS PRESENT	BANGUI SCALE AIDS ABSENT	TOTAL
Positive	338 (1.2%)	2 796 (10.1%)	3 134 (11.3%)
Negative	2 575 (9.3%)	22 072 (79.4%)	24 647 (88.7%)
Total	2 913 (10.5%)	24 868 (89.5%)	27 781 (100%)

Prevalence: 2913/27781 = 11 per cent (CI 95% 11.6, 12)
Sensitivity: 338/2913= 12 per cent (CI 95% 9, 16)
Specificity: 22072/24868 = 90 per cent (CI 95% 89, 91)
PV+: 338/3134 = 11 per cent
PV- : 22072/24647= 90 per cent.

Looking at the estimates, clearly the Bangui scale was not predictive when used with the weighted sample.

3.1.3 Discussion of the Bangui case definition results

The Bangui case definition is evidently not very useful when used for children in both weighted and unweighted samples. The low sensitivity and low positive predictive value meant it was not able to identify accurately diseased individuals.

In the case of adults, the definition was generally better able to identify accurately diseased individuals, particularly with unweighted data.

Notably sensitivity and specificity as used in this study, are partly computed from information obtained from questionnaires. Normally such information has inherent biases. With the sensitive nature of the information, we cannot exclude the possibility of errors that might have lead to misclassification by disease status.

To validate the Bangui scale further, we computed and compared AIDS prevalence by province from the Bangui and HIV tests. Results are given below in Table 26.

Table 26:A comparison of prevalence by province determined through HIV test and Bangui scale

		HIV TEST RESULTS		BANGUI SCALE	
		Positive	Negative	AIDS present	AIDS absent
Unweighted data					
Total	%	35.0	65.0	16.2	83.8
	n	222	412	103	531
Free State	%	41.0	59.0	13.3	86.7
	n	68	98	22	144
KwaZulu-Natal	%	32.9	67.1	22.7	77.3
	n	74	151	51	174
Mpumalanga	%	36.0	64.0	19.8	80.2
	n	31	55	17	69
North West	%	31.2	68.8	8.3	91.7
	n	49	108	13	144
Structural test		p=0.254		p=0.001	
Weighted data					
Total	%	28.0	72.0	9.1	90.9
	n	42 957	110 368	14 006	139 318
Free State	%	37.8	62.2	7.0	93.0
	n	13 391	22 034	2 495	32 930
KwaZulu-Natal	%	23.7	76.3	10.4	89.6
	n	16 779	53 901	7 372	63 307
Mpumalanga	%	29.4	70.6	18.7	81.3
	n	3 602	8 630	2 284	9 948
North West	%	26.3	73.7	5.3	94.7
	n	9 185	25 803	1 855	33 133
Structural test		p=0.187		p=0.348	

When comparing 'HIV test prevalence' and 'Bangui scale indicator prevalence' on the tested population, we see that the Bangui indicator is less likely to identify cases (Table 27). As a consequence, HIV prevalence is much higher for every province in the case of the HIV test than in case of the Bangui indicator. This is expected because not all people who test positive have AIDS.

Table 27: AIDS prevalence by characteristics of respondents, unweighted

		BANGUI SCALE				HIV TEST		
	n	% AIDS present	% AIDS absent	p	n	Positive %	Negative %	p
Total		16.2	83.8			35	65	
n	634	103	531		634	222	412	
Gender				0.439				0.09
Male	213	17.8	82.2		213	30.5	69.5	
Female	421	15.4	84.6		421	37.3	62.7	
Age				0.707				0.0001
(0–14)	85	17.6	82.4		85	8.2	91.8	
(15–49)	549	16	84		549	39.2	60.8	
Age				0.435				0.0001
0–14	85	17.6	82.4		85	8.2	91.8	
15–24	181	13.3	86.7		181	29.8	70.2	
25–49	368	17.4	82.6		368	43.8	56.3	
Race				0.074				0.004
African	591	17.3	82.7		591	36.5	63.5	
Indian	12	0	100		12	0	100	
Coloured	14	7.1	92.9		14	35.7	64.3	
White	17	0	100		17	5.9	94.1	

3.1.4 Comparison of other prevalence indicators

Table 26 indicates that the Bangui scale underestimated the overall HIV prevalence by 18.8 per cent (35 per cent–16.2 per cent). When comparisons are made according to gender, the Bangui scale yielded insignificant results for males and females (p=0.44), while the HIV test yielded significant results (p=0.09). This is also applicable to comparisons by different age groups.

A notable underestimation of HIV by the Bangui scale is evident with the prevalence of white respondents. The Bangui test yielded 0 per cent prevalence while in reality it is 5.9 per cent for this racial group.

We find similar results for weighted data as shown in Table 28 below.

Table 28: HIV prevalence by characteristics of respondents, weighted

		BANGUI SCALE				HIV TEST		
	n	% AIDS present	% AIDS absent	p	n	Positive %	Negative %	p
Total	153325	9.1	90.9			28.0	72.0	
n		14007	139318		153325	42957	110368	
Gender				0.702				0.09
Male	47767	9.8	90.2		47767	21.7	78.3	
Female	105558	8.8	91.2		105558	30.9	69.1	
Age				0.659				0.045
(0 to 14)	27780	10.5	89.5		27781	11.3	88.7	
(15 to 49)	125544	8.8	91.2		125544	31.7	68.3	
Age				0.542				0.047
0 to 14	27780	10.5	89.5		27781	11.3	88.7	
15 to 24	53012	6.9	93.1		53012	25.6	74.4	
25 to 49	72532	10.3	89.7		72532	36.2	63.8	
Race				0.679				0.61
African	140569	9.9	90.1		140569	28.9	71.1	
Indian	4578	0.0	100.0		4578	0.0	100.0	
Coloured	4195	2.0	98.0		4194	40.5	59.5	
White	3983	0.0	100.0		3983	16.6	83.4	

Table 28 confirms the tendency of the Bangui scale to underestimate HIV prevalence. In this instance it is underestimated by 18.9 per cent.

We further tested the validity of the Bangui case definition by computing and comparing prevalence by province and by type of facility, for both weighted and unweighted samples. The results are given in Table 29 below.

Table 29: HIV prevalence by facilities' characteristics, unweighted

		BANGUI SCALE				HIV TEST		
	n	% AIDS present	% AIDS absent	p	n	Positive %	Negative %	p
n		103	531			222	412	
Total	634	16.2	83.8		634	35	65	
Type of facility				<0.0001				<0.0001
PHC facility/ Clinic	355	8.5	91.5		355	25.9	74.1	
Private Hospital	53	7.5	92.5		53	37.7	62.3	
State Academic/ state	226	30.5	69.5		226	48.7	51.3	
Province of facility				0.001				0.25
Free State	166	13.3	86.7		166	41	59	
KwaZulu-Natal	225	22.7	77.3		225	32.9	67.1	
Mpumalanga	86	19.8	80.2		86	36	64	
North West	157	8.3	91.7		157	31.2	68.8	

In both weighted and unweighted samples the Bangui scale yielded lower prevalence than the HIV test. The 18.8 per cent (35.0–16.2 per cent) underestimation is consistent with the other results. This is clear demonstration of the fact that the Bangui scale measures AIDS while the HIV test measures the serostatus of the patients.

A possibility of underestimating AIDS cases exists because the Bangui scale is interview-based. All interviews are inevitably susceptible to information bias. In this study, bias would arise from the following circumstances.

First, fear of being diagnosed with AIDS (particularly those who know the symptoms) might make respondents deny the presence of such symptoms, leading to incorrect diagnosis. Second, parents and guardians reported on behalf of their children. It is likely that some details would be inaccurate. Third, children who report on their symptoms may over- or under-exaggerate the presence of symptoms.

In the paragraphs below we estimate the number of AIDS cases using modelling. In addition, we model the number of AIDS cases that will be seen in public health facilities.

Table 30: HIV prevalence by facilities' characteristics (weighted)

	n	BANGUI SCALE % AIDS present	% AIDS absent	p	n	HIV TEST Positive %	Negative %	p
		14007	139317			42958	110367	
Total	153324	9.1	90.9		153325	28	72	
Type of facility				<0.0001				0.0001
PHC facility/ Clinic	134755	6.6	93.4		134756	25.7	74.3	
Private hospital	2087	6.7	93.3		2087	36.6	63.4	
State Academic/ state	16482	30	70		16482	46.2	53.8	
Province of facility				0.332				0.18
Free State	35425	7	93		35425	37.8	62.2	
KwaZulu-Natal	70679	10.4	89.6		70680	23.7	76.3	
Mpumalanga	12232	18.7	81.3		12232	29.4	70.6	
North West	34988	5.3	94.7		34988	26.3	73.7	

3.2 Modeling AIDS cases

A key objective of this study was to project the AIDS patient load on health facilities. To achieve this for public health facilities requires calculation of the following set of figures:

- Projection of annual AIDS cases; and
- Proportion of AIDS cases likely to be seen in public health facilities.

The Epidemic Projection Package (EPP) and Spectrum model package was used for estimating the annual number of new AIDS cases during the time period 1990–2020. A detailed description of the applied equations and assumptions in EPP and Spectrum can be found in the UNAIDS manual (2002).

EPP is a methodology for estimating prevalence from surveillance data developed by the UNAIDS Reference Group on Estimates, Models and Projections (UNAIDS, 2002). The EPP model aims to find the best fitting curve that describes the evolution of adult HIV prevalence over time. The Spectrum model package, developed by the Futures Group in 1999, combines the epidemiological calculations of HIV/AIDS (AIM Version 4) with demographic calculations, to translate the prevalence estimate from EPP into estimates of the number of people infected, new AIDS cases, and AIDS deaths. Spectrum contains a demographic projection model (DemProj) that projects the population by age and sex on the basis of fertility, mortality and migration.

Demographic variables required by the model are derived from the United Nations Population Division database, the 2000 Revision. The national HIV prevalence surveys among pregnant women from 1990–2001, and the first national, population-based HIV survey in 2002, served as the prime data sets to prepare the epidemiological input values (Shisana et al., 2002). A crucial parameter in the model is the progression from HIV infection to AIDS and AIDS deaths. For adults, the median time from infection to AIDS is assumed to be eight years and from AIDS to death, one year. For children who are infected perinatally, about half experience a rapid progression from infection to death (approximately 50 per cent die within two years) and the other half experience a much slower progression. Other important default values used in the model determine the perinatal transmission rate, fertility reduction due to HIV infection, and patterns for the age distribution of HIV infection and the ratio of female to male prevalence. Some of these patterns were modified to create a scenario customised for South Africa.

3.3 Results

The projections of new AIDS cases are shown in Figure 6 and Table 31. A 30 per cent increase in new AIDS cases is estimated from the year 2002 to 2007, when the number of new AIDS cases is projected to peak at 486 120. In order to calculate the number of patients with AIDS who are eventually seen in the public health care sector, we used the October 1999 household survey data reported by Stats SA. The analysis showed that 51.5 per cent of all persons seeking care are served by the public health care sector. Applying this figure to patients with AIDS seems reasonable. Therefore, we assume that at least half of the projected AIDS cases will seek treatment in public health sector facilities.

Figure 6: Projected new AIDS cases

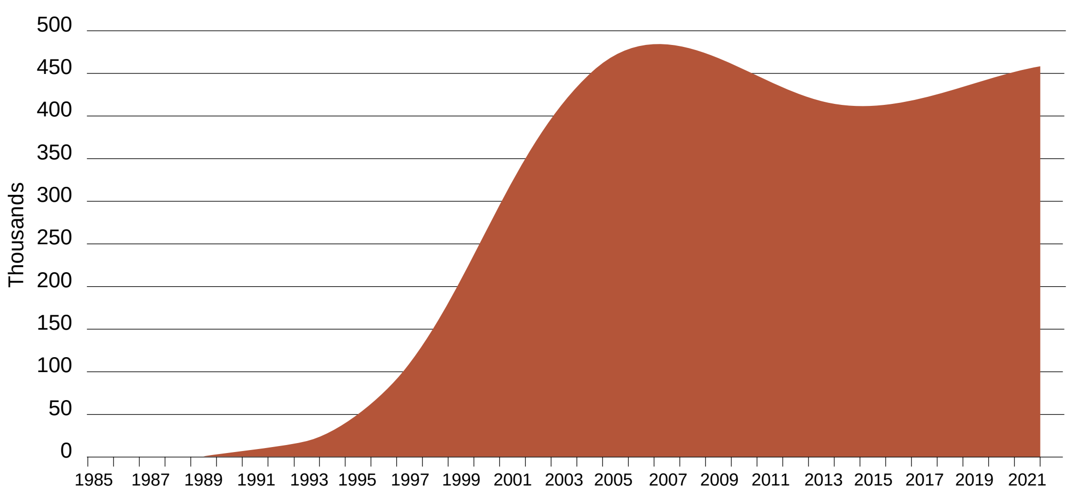


Table 31: Projected annual new AIDS cases (thousands), 1990-2020

YEAR	NEW CASES	YEAR	NEW CASES
1990	1.85	2006	483.24
1991	4.13	2007	486.12
1992	8.32	2008	481.29
1993	15.69	2009	471.24
1994	28.11	2010	458.86
1995	47.77	2011	446.72
1996	76.74	2012	436.99
1997	115.56	2013	430.02
1998	162.88	2014	427.12
1999	216.04	2015	426.42
2000	271.50	2016	428.79
2001	325.45	2017	432.67
2002	374.30	2018	437.93
2003	416.58	2019	444.26
2004	448.66	2020	450.59
2005	471.03		

4. Conclusions

The EPP/Spectrum model projects a 30 per cent increase in the prevalence of AIDS in the general population for the period 2002–2007. This increase is expected to lead to a 40–45 per cent increase within health care facilities as more people seek treatment, testing and counselling.

This projection is supported in the current findings reported in Study No. 3. An escalation in the number of patients admitted for HIV-related diseases in 35 of 54 hospitals which provided figures, increased mean length of stay in hospitals for AIDS patients, and increased demands for more staff to cope with increasing patient load as expressed in 80 per cent of facilities, are evidence in support of projected increases.

Further supporting evidence is given in Study No. 2 in terms of human resource issues of increasing workload, lowered job morale, frequent absenteeism, frequent requests for sick leave, and heightened stress levels.

If the health care system (particularly the public sector) fails to cope with current prevalence of 28 per cent in facilities, we can expect the situation to deteriorate in the face of 40–45 per cent projection. Devoting more resources to health care, particularly in the public health sector, must become top priority for policy makers.