Prevalence of HIV in workforces in southern Africa, 2000 - 2001

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Objectives. Most data on HIV prevalence in low-risk populations in sub-Saharan Africa are drawn from sentinel surveys of pregnant women attending antenatal clinics and are not representative of formal sector workforces. We surveyed workforces in southern Africa to determine HIV prevalence among formally employed, largely male populations.

Methods. Voluntary, anonymous, unlinked seroprevalence surveys of 34 workforces with 44 000 employees were carried out in South Africa, Botswana, and Zambia in 2000 - 2001. Results were stratified to obtain estimates of prevalence by industrial sector, location, age, sex, and job level.

Results. Average HIV prevalence for the entire sample was 16.6% (95% CI: 16.3 - 17.0%). Country-wide prevalence was 14.5% (14.1 - 14.9%) in South Africa, 17.9% (17.1 - 18.7%) in Zambia, and 24.6% (23.6 - -25.7%) in Botswana. Among industrial sectors, mining (18.0%, 17.6 - 18.5%) and metal processing (17.3%, 15.9 - 18.7%) had the highest infection rates. Males, who comprised 85% of participants of known sex, were more likely (16.3%, 15.3 - 17.4%) to be infected than were females (10.7%, 8.7 - 12.7%). Contract (23%, 21.9 - 24.1%), unskilled (18.3%, 17.5 - 19.1%), and semi-skilled workers (18.7%, 18.1 - 19.4%) were much more likely to be infected than were skilled workers (10.5%, 9.5 - 11.4%) and managers (4.5%, 3.4 - 5.6%). Participation in the surveys averaged 63% of eligible employees.

Conclusions. HIV prevalence among formally employed workers in southern Africa shows different patterns than among antenatal clinic attendees. Anonymous workplace surveys generate prevalence estimates for demographic groups that are not represented in antenatal surveys and can strengthen support for prevention and treatment interventions.

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Most of the data available on the extent of HIV infection in low-risk populations in sub-Saharan Africa are drawn from annual sentinel surveys of pregnant women attending public antenatal clinics.[1] Such surveys have been an effective way to obtain high quality national data that can be compared across countries and over time, but they are not representative of subpopulations that differ in sex, age, socio-economic status, or other factors from the population of pregnant women using the public health system.[2] In order to obtain accurate estimates of HIV prevalence in these subpopulations, other types of surveillance are needed.

One subpopulation that is poorly represented by antenatal data is formal sector workforces. Published HIV prevalence data on African workforces are almost nonexistent, in part because workforces are rarely tested. Mandatory pre- or in-service testing is illegal in South Africa and in many other countries in the region. Most adults have never been tested for HIV, and the fear and stigma associated with HIV/AIDS ensure that even those who are tested do not reveal their status to others.

In southern Africa the employees of large, private sector firms are largely male,[3] include a larger proportion of individuals above age 40 than occurs in the antenatal clinic (ANC) population, and, by virtue of being employed in wage labour, are higher on the socio-economic scale than the population at large, of whom the great majority are self-employed, unemployed, or employed in the informal sector.[4] In southern Africa, they are also more likely to be migrants who live away from their families for long periods of time. All of these factors imply that HIV in formal sector workforces will not be well described by national or provincial ANC data. For example, the sole published report[5] we are aware of showing seroprevalence data for a South African workforce found a company-wide infection rate of 6.8% in 1998. The country's sentinel ANC survey[6] recorded a nation-wide rate of 22.8% the same year.

For businesses in southern Africa, the increase in labour costs due to HIV/AIDS among employees has been conservatively estimated at 1 - 6 %.[7] Absenteeism, illness on the job, and labour turnover are having severe effects on labour productivity. The costs of health care and employee death and disability benefits are skyrocketing.[8] If firms are to weather the

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HIV/AIDS storm and provide appropriate prevention and care services to employees and their families, they must have accurate information on how many in the workforce are affected. Such information is also critical to emerging efforts to provide access to antiretroviral therapy.

In view of the lack of published information, a number of businesses in southern Africa have commissioned voluntary, anonymous HIV seroprevalence surveys of their workforces. Such surveys are legal and are increasingly acceptable to unions, managers and governments in southern Africa as a fast and relatively accurate way to estimate prevalence in defined populations. In 2000 to 2001, we participated in 34 such surveys involving more than 44 000 employees of firms in South Africa, Botswana, and Zambia. This paper reports the results of those surveys.

Methods

Data collection

The data reported here were generated at private sector firms that had contracted with a consulting firm, AIDS Management and Support, to estimate the prevalence of HIV among employees. Before doing the surveys, a series of meetings and presentations were held with managers, employee representatives and union shop stewards, labour relations officers, health care staff, and other stakeholders. During these meetings, participants were informed about the purpose of the survey, the potential uses of the results, and the process by which samples would be collected. Individuals were also assured of complete confidentiality.

To avoid identifying subsets of the workforce or individual employees, and possibly reducing the participation rate, the surveys were designed to test the entire workforce present at each site when the survey was conducted.

At the time of the survey at each site, a team of registered nurses collected saliva specimens from each participant. Groups of employees were invited to participate at the start of their work shifts. Upon entering the workplace, each employee received a specimen container with a label on which to record age (by 5- or 10-year range), job level (typically 4 - 5 levels per company), and in some cases sex. The categories for these covariates were agreed upon with employee representative bodies and were defined to be broad enough to ensure that individuals remained anonymous while still providing relevant demographic information for analysis. Nurses recorded the demographic and category information on the specimen container. After providing this information the required amount of saliva was collected in the container.

Union officials were encouraged to observe the process to verify the full anonymity of the survey. Employees who wished to know their status were offered free counselling and testing separate from the survey.

Samples were tested using a laboratory-based HIV enzyme-linked immunosorbent assay (ELISA) saliva test (Wellcozyme HIV 1&2 GACELISA, Abbot-Murex). This test has high sensitivity (approximately 98 - 99%) and is suitable for surveillance purposes.[9-11] The specimens were refrigerated on site and later transported to Johannesburg for laboratory analysis. Results were later sent to Boston University for statistical analysis. The University of the Witwatersrand's Committee for Research on Human Subjects (Medical) provided ethical approval for the surveys.

Data analysis

All employees in the analysis were coded as to their HIV status. We then coded age groups and job levels and grouped firms according to location and industrial sector. Age groups were aggregated into 10-year ranges, each of which overlapped two of the 5-year groups used by UNAIDS.

We had complete data on HIV status, location, and industrial sector for all participants. Data on job level, age, and sex were missing entirely for some companies, where the workforces had not agreed to provide such information, and for some individual employees within companies. Participants who had missing data on age group or job level were coded as unknown and analysed as a group.

Prevalence was calculated for each analysis as the number of study participants in the group who were HIV-positive divided by the total number tested in each group. For each estimate we computed standard 95% confidence intervals (CIs). Negative lower confidence bounds were truncated at zero. Prevalence estimates were then stratified to obtain stratum-specific estimates of prevalence by industrial sector, location, age group, sex, and job level. As limited data on participants' sex were available for many of the datasets, we computed prevalence stratified by sex and age only for the six datasets that had complete or near-complete information.

Results

A total of 44 094 employees from 34 companies were tested. The firms and workforces are described in Table I, ordered by location and number tested in each firm. Data were missing entirely for job level at 8 companies, age at 1, and sex at 25. Approximately 65% of the employees and 76% of the firms were in South Africa; the remainder were in Zambia (21% of employees and 12% of firms) and Botswana (14% of employees and 12% of firms). Fully half of all the firms were mining or mineral processing operations — including all but 1 in Botswana and Zambia — consistent with that sector's predominance in the economies of southern Africa and the relatively high level of concern about HIV/AIDS shown by mining managers. Participation in the surveys ranged from a high of 98% to a low of 40%.

Table I. Workforces surveyed

Country and province (South Africa only)	Sector/company type	Year surveyed	Number surveyed	% of permanent workforce surveyed*
Botswana	Mining 1 firm	2000	280	53
Botswana	Mining 3 firms	2001	5 960	68 - 86
Subtotal Botswana	4 firms		6 240	72
SA—Gauteng	Manufacturing† 1 firm	2000	126	79
SA—Gauteng	Mining 1firm	2000	1 039	77
SA—Gauteng	Other‡ 2 firms	2000	2 405	64 - 68
SA—KwaZulu-Natal	Manufacturing 4 firms	2000	3 271	63 - 98
SA—KwaZulu-Natal	Mining 2 firms	2000	562	40 - 79
SA—KwaZulu-Natal	Other 1 firm	2000	484	51
SA—Northern Cape	Mining 2 firms	2000	2 251	60 - 65
SA—Gauteng	Manufacturing 2 firms	2001	1 186	66 - 72
SA—Gauteng	Mining 2 firms	2001	1 163	67 - 71
SA—Gauteng	Other 2 firms	2001	1 092	41 - 96
SA—KwaZulu-Natal	Manufacturing 2 firms	2001	2 105	63 - 66
SA—Mpumalanga	Manufacturing 1 firm	2001	1 145	61
SA—Mpumalanga	Mining 1 firm	2001	976	69
SA—Northern Cape	Mining 1 firm	2001	1 448	70
SA—North West	Manufacturing I firm	2001	103	83
SA—North West	Mining 1 firm	2001	9 153	43
Subtotal South Africa	26 firms		28 509	60
Zambia	Mining 3 firms	2001	7 881	55 - 82
Zambia	Manufacturing 1 firm	2001	1 464	67
Subtotal Zambia	4 firms		9 345	67
Total	34 firms		44 094	63

*On any given day, approximately 10% of employees are typically away from the workplace due to vacation leave, sick leave, business travel, etc. and as such would not have been available to participate in the survey. A higher proportion of employees present in the workplace on the day of the survey therefore actually participated in the survey than is shown in this column.
†Manufacturing includes paper and pulp, beverages, metal processing and construction materials.
‡Other includes infrastructure and transport.

Aggregate prevalence results for all the firms surveyed are shown in Fig. 1. Each of the columns in Fig. 1 represents 1 company, arranged by order of HIV prevalence.

The prevalence of HIV infection by industrial sector and location is shown in Table II. Firms in the mining and metal processing sectors averaged nearly 1 in 5 employees infected with HIV. Prevalence was somewhat lower for manufacturing and other firms, although prevalence still exceeded 10%. Average prevalence in the surveyed companies by location (country or South African province) was consistently lower than that reported from ANC surveys in 2001,[6] as shown for comparison in the far right column of Table II.

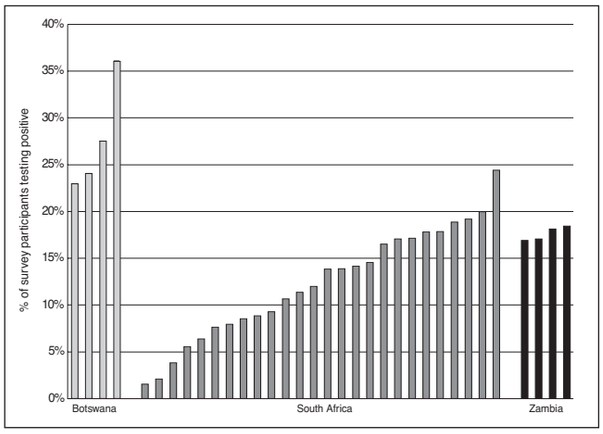

Fig. 1. Per cent of surveyed workforce HIV-positive by country.

In Table III, HIV prevalence is disaggregated by age group and location (the vast majority of surveys do not usually collect data on sex because the vast majority of employees are male, hence detailed sex-specific prevalence is not provided). Sex was known for a subset of 7 198 employees (16% of the total surveyed), of whom 6 137 were male and 1 061 female. Males had higher point estimates of prevalence than did females in the 30 - 39-year age group (23.1% and 14.9% respectively) and 40 - 49-year age group (12.4% and 4.5% respectively). Prevalence was highest in the 30 - 39-year age groups for males (23.1%), compared with 13.7% in the 20 - 29-year and 12.4% in the 40 - 49-year age bands in this subset. There was little difference in prevalence among females between the 20 - 29-year (14.6%) and 30 - 39-year age groups (14.9%), and little difference between males (13.7%) and females (14.6%) in the 20 - 29-year age group. A similar pattern of infection by age

Table II. HIV prevalence by industrial sector and location (per cent HIV+ and 95% confidence interval in group)

Province	Industrial sector					ANC prevalence 2001*
	Mining	Metal processing	Manufacturing	Other	All	
Botswana	24.6 (23.6 - 25.7)				24.6 (23.6 - 25.7)	44.9
South Africa	15.5 (15 - 16.1)	17.8 (15.8 - 19.8)	13.0 (12.1 - 13.8)	11.6 (10.6 - 12.6)	14.5 (14.1 - 14.9)	
Gauteng	11.0 (9.7 - 12.4)		6.4 (5.1 - 7.8)	11.3 (10.2 - 12.3)	10.3 (9.6 - 11.0)	29.8
KwaZulu-Natal	12.6 (9.9 - 15.3)	17.8 (15.8 - 19.8)	13.6 (12.6 - 14.7)	13.8 (10.7 - 16.9)	14.4 (13.6 - 15.3)	33.5
Mpumalanga	24.3 (21.6 - 27.0)		17.8 (15.6 - 20)		20.8 (19.1 - 22.5)	29.2
Northern Cape	7.4 (6.5 - 8.2)				7.4 (6.5 - 8.2)	15.9
North West	19.1 (18.3 - 19.9)		16.5 (9.3 - 23.6)		19.1 (18.3 - 19.9)	25.2
Zambia	18.1 (17.2 - 18.9)	16.8 (14.9 - 18.8)			17.9 (17.1 - 18.7)	30.7
All	18.0 (17.6 - 18.5)	17.3 (15.9 - 18.7)	13.0 (12.1 - 13.8)	11.6 (10.6 - 12.6)	16.6 (16.3 - 17)	

*For comparison.

Table III. HIV prevalence by sex and age group and by location and age group (per cent HIV+ and 95% confidence interval in group)

Location	Age group (yrs)*					
	<20	20 - 29	30 - 39	40 - 49	> 49†	All
Botswana	3.1 (0.0 - 6.6)‡	21.9 (19.9 - 23.8)	34.5 (32.4 - 36.6)	19.4 (17.5 - 21.3)	18.1 (15.1 - 21.0)	24.6 (23.6 - 25.7)
South Africa	2.3 (0.0 - 4.6)	15.5 (14.5 - 16.4)	17.5 (16.7 - 18.3)	13.6 (12.9 - 14.3)	10.3 (9.4 - 11.2)	14.5 (14.1 - 14.9)
Zambia	5.2 (0.0 - 11)‡	11.4 (10.2 - 12.5)	25.7 (24.2 - 27.2)	18.4 (16.7 - 20.0)	10.0 (8.0 - 11.9)	17.9 (17.1 - 18.7)
All	3.1 (1.2 - 5.0)	15.4 (14.7 - 16.1)	21.9 (21.2 - 22.5)	15.1 (14.5 - 15.7)	11.1 (10.3 - 11.9)	16.6 (16.3 - 17.0)

*Participants who did not provide age data excluded.
†Insufficient data for sex-specific estimates.
‡ Confidence interval truncated at 0.0%.

was seen within each country, with peak prevalence occurring among 30 - 39-year olds in all three countries. This pattern differs from ANC-based estimates of age-specific HIV prevalence in South Africa,[5] Botswana,[12] and Zambia,[13] where prevalence is highest in the 25 - 29-year age group. This relatively small dataset suggests that employed females are less vulnerable to HIV infection than unemployed women. However, a larger sample would be needed to confirm this finding.

In Table IV, HIV prevalence is disaggregated by job level and location. Contract, unskilled, and semi-skilled workers had substantially higher infection rates than skilled employees, who were in turn far more likely to be HIV-positive than managers. Prevalence was particularly high among contract workers overall, averaging 23%.

Discussion

This paper presents data on HIV prevalence in 34 private sector workforces in South Africa, Botswana, and Zambia in 2000 and 2001. These data represent what may be the largest dataset yet reported on the HIV status of formally employed, male adults in the southern African region. In many areas the HIV prevalence has continued to increase. Notwithstanding,

Table IV. HIV prevalence by job level and location (per cent HIV+ and 95% confidence interval in group)

	Job category						
Province	Contract	Unskilled	Semi-skilled	skilled	Management	Other/ Unknown	All
Botswana	28.5 (26.5 - 30.5)	27.3 (24.0 - 30.5)	24.9 (23.1 - 26.7)	19.2 (16.9 - 21.6)	6.9 (3.5 - 10.3)	20.5 (7.8 - 33.1)	24.6 (23.6 - 25.7)
South Africa	20.4 (19.0 - 21.8)	14.8 (13.3 - 16.3)	17.7 (17.0 - 18.4)	6.7 (5.7 - 7.6)	4.1 (3.0 - 5.2)	12.2 (11.5 - 12.9)	14.5 (14.1 - 14.9)
Zambia	18.0 (14.5 - 21.4)	18.4 (17.5 - 19.4)	17.0 (15.3 - 18.4)	26.4 (11.6 - 41.3)	3.5 (0.0 - 10.4)*	13.9 (10.8 - 16.9)	17.9 (17.1 - 18.7)
All	23.0 (21.9 - 24.1)	18.3 (17.5 - 19.1)	18.7 (18.1 - 19.4)	10.5 (9.5 - 11.4)	4.5 (3.4 - 5.6)	12.3 (11.6 - 13)	16.6 (16.3 - 17)

*Confidence interval truncated at 0.0%.

these HIV data provide an 8 - 10-year 'preview' for the subsequent AIDS epidemic and these data should be valuable for this purpose. The authors intend to update the data in the future with more workplace HIV prevalence studies done in 2002/3.

The data reveal both similarities and differences among the companies surveyed and between the workforce and ANC results. Among the firms, prevalence appears to be highest in the mining sector, but other sectors have equal or greater infection rates in some locations. Contract, unskilled, and semi-skilled workers are more likely to be infected than are skilled workers and managers, with the exception of the Zambian mining sector, where skilled workers have a very high infection rate. Previous research has identified a number of reasons for high HIV infection rates among less-skilled employees in the mining sector. These include, among others, a high proportion of migrant labour (workers whose jobs require them to live away from home), frequent purchase of commercial sex, and physical dangers on the job that make a future threat such as AIDS seem less important than it might otherwise appear.[14]

Contract (non-permanent) employees have the highest infection rates in most companies surveyed. Contract workers, such as cleaners, security guards, and food service employees, are typically unskilled or semi-skilled, often live away from their homes, and frequently do shift work that further isolates them from stable communities. Since they are not formally employed by the firms for which they work, they often miss out on HIV prevention programmes and other employee support mechanisms and are socially isolated and economically unstable.

HIV prevalence in the workforces surveyed, while extremely high in some companies, was lower than the median prevalence reported from ANC survey data for all locations and most age groups. The exception is the 40 - 49-year age group in South Africa, where average prevalence in the workforce was almost identical to that among ANC attendees. This may reflect the effect of male infection rates 'catching up' to those of females as men get older. The workforce surveys found a surprisingly high rate of infection among employees older than 49 years, just over 10% in South Africa and Zambia and 18% in Botswana. There are no ANC data for this age group.

Across all countries, sectors, job levels, and age groups, HIV prevalence averaged nearly 17%. In several of the workforces, more than 1 of 4 employees was HIV-positive at the time of the survey. These figures suggest that the epidemic will have serious financial and human resource consequences for businesses and labour markets in the region.

Voluntary, anonymous HIV seroprevalence surveys have proved to be a valuable addition to workplace HIV/AIDS programmes. A survey generates site-specific information that can be accepted by managers and workers who might otherwise disagree on the magnitude of the problem and the appropriate response. The results provide data with which to monitor the epidemic in the company, target and evaluate HIV prevention efforts, plan for labour turnover and training needs, manage employee benefits, and assess the feasibility of treatment and care programmes. Surveys also serve as a 'wake up call' for managers, workers, unions, and the government, calling their attention to the epidemic and forcing them to confront and address its consequences.

The study had a number of limitations. At the level of the firms, participating companies selected themselves for inclusion in the surveys and may not be representative of all firms in their sectors or countries. Most of the companies surveyed were in the mining and manufacturing sectors, leaving us with few data on other critical sectors such as agriculture, construction, financial services, tourism, retail, and transport. It also leaves us with little information on the informal sector. Samples were very small for some sectors, job levels, age groups, and locations.

At the level of individual participants, the most important limitation of the study is selection bias due to incomplete

participation by employees who chose not to provide samples. Non-participation was relatively modest in some firms but quite substantial in others. We were not able to determine whether those who opted out of the surveys differed in any pertinent ways from those who did participate. Some individuals may have avoided participation because they knew or feared they were HIV-positive and did not trust the anonymity of the tests; others may have known or believed themselves to be HIV-negative and did not consider it necessary to participate. The former reason would bias the survey results downward, while the latter would lead the results to overestimate actual prevalence. For surveys where participation was relatively low, results should be viewed with caution. Finally, data on age, sex, and job level were self-reported and could not be verified in unlinked surveys.

Conflict of interest. C Evian is the director of AIDS Management & Support, the consulting firm that was contracted by the participating companies to carry out the surveys.

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