Young people's sexual health in South Africa: HIV prevalence and sexual behaviors from a nationally representative household survey

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Objectives: To determine the prevalence of HIV infection, HIV risk factors, and exposure to national HIV prevention programs, and to identify factors associated with HIV infection among South African youth, aged 15–24 years.

Design: A cross-sectional, nationally representative, household survey.

Methods: From March to August 2003 we conducted a national survey of HIV prevalence and sexual behavior among 11 904 15–24 year olds. Multivariable models for HIV infection were restricted to sexually experienced youth.

Results: Young women were significantly more likely to be infected with HIV in comparison with young men (15.5 versus 4.8%). Among men, a history of genital ulcers in the past 12 months was associated with HIV infection [adjusted odds ratio (AOR), 1.91; 95% confidence interval (CI), 1.04–3.49) whereas among women a history of unusual vaginal discharge in the past 12 months was associated with HIV infection (AOR, 1.75; 95% CI, 1.26–2.44). Young women with older partners were also at increased risk of HIV infection. Among both men and women, increasing partner numbers and inconsistent condom use were significantly associated with HIV infection. Males and females who reported participation in at least one loveLife program were less likely to be infected with HIV (AOR, 0.60; 95% CI, 0.40–0.89; AOR, 0.61; 95% CI, 0.43–0.85, respectively).

Conclusion: This survey confirms the high HIV prevalence among young people in South Africa and, in particular, young women's disproportionate risk. Programs for youth must continue to promote partner reduction, consistent condom use and prompt treatment for sexually transmitted infections while also addressing contextual factors that make it difficult for them to implement behavior change.

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Received: 10 February 2005; revised: 20 June 2005; accepted: 28 June 2005.

Introduction

Young people in sub-Saharan Africa continue to be one of the populations at greatest risk for HIV infection, particularly young women [1,2]. Based on the 2003 South African antenatal clinic survey, HIV prevalence among 15–19-year-old women appears to be stabilizing at around 15% whereas in the 20–24-year-old age group the prevalence increased from 2002 levels to 30% [3]. Given the urgency of preventing new HIV infections, the determination of whether changes in the HIV epidemic are occurring and whether these can be attributed to HIV prevention programs is a very high priority.

In 2003 we conducted a nationally representative, household survey of young South Africans aged 15–24 years which collected information on HIV prevalence, HIV-related risk and protective factors, and exposure to national HIV prevention programs. The survey is one of the largest national population-based HIV-1 prevalence surveys among young people conducted worldwide to date. It provides a unique insight into the dynamics of HIV infection and associated risk behaviors in this age group. We aim to repeat these surveys over time in order to monitor HIV prevalence and related risk and protective behaviors so that HIV interventions can be tailored to be more effective. A secondary aim of the surveys is to determine if youth who are exposed to national prevention programs, in particular the loveLife adolescent HIV prevention program, have a lower prevalence of HIV and related risk behaviors in comparison with youth who are not exposed to such programs. The loveLife program is a national HIV prevention program for youth in South Africa that combines a sustained multi-media awareness and education campaign with a nationwide program of youth-friendly sexual health and outreach services (www.loveLife.org.za). Results from the first round of the survey are presented in this paper.

Methodology

Sample
The survey employed a three-stage disproportionate, stratified design to identify a nationally representative sample of young people 15–24 years of age living in the nine provinces in South Africa. Using the 2001 national census as the sampling frame, census enumeration areas were utilized as the primary sampling unit. Households within sampled enumeration areas were enumerated and one eligible young person per household was randomly selected to take part in the interview.

Interview
Inclusion criteria for the study required participants to both provide an oral fluid specimen to test for HIV antibodies and to complete a comprehensive structured face to face interview. The interview covered demographics, sexual behavior, symptoms of sexually transmitted infections (STI) and exposure to prevention programs. It was translated from English into Sotho, Zulu, Tswana, Xhosa, Pedi, Venda, Tsonga, and Afrikaans and then back translated.

Informed consent was obtained from all young people and parental consent was also obtained for those aged 15–17 years. The study was approved by the Committee for the Protection of Human Subjects, University of the Witwatersrand, South Africa. Experienced interviewers aged 18–35 years underwent a week-long training and were matched to interviewees on gender and race. Study participants were informed that their HIV results would not be returned to them, and were referred to the nearest centre for HIV testing if they wanted to ascertain their status.

Laboratory methods
Oral fluid samples were collected using the Orasure HIV-1 Oral Specimen Collection Device (Orasure Technologies Inc., Bethlehem, Pennsylvania, USA) and tested for HIV-1/2 antibodies using the Vironostika Uni-Form II HIV-1/2 plus O MicroElisa System (Biomerieux, Durham, North Carolina, USA) at a central laboratory in Johannesburg. Using Orasure tested with an enzyme-linked immunosorbent assay, sensitivities and specificities of 99% were reached in a study of 3569 cases [4].

Statistical analysis
The final sample was weighted to account for differential sampling probabilities, and to represent the distribution of young people aged 15–24 years in South Africa based on the 2001 census. Analyses were conducted using STATA 8.0 (College Station, Texas, USA) allowing for sample strata, primary sampling units and population weights. Chi-square tests were used to test for differences between HIV risk factors and HIV status for men and women. Multivariable logistic regression was used to determine risk factors for HIV infection. Models were restricted to sexually experienced youth. Interaction by gender and age was explored, and models were stratified by gender. Two multivariate models are presented. The first model (see Table 3 below) explored sexual behavior and biological risk factors for HIV infection. In this model, we simultaneously evaluated those factors found to be significant in bivariate analyses ($P \leq 0.1$) and those theorized, *a priori*, to be important HIV risk factors. Specifically, these included sociodemographic factors, behavioral variables, and symptoms of STI. The second model (see Table 4 below) explored the relationship between factors theorized to reduce HIV risk and HIV infection. In this model we controlled for sociodemographic factors only as sexual behaviors and STI symptoms probably lie on the causal pathway between the factors in Table 4 and HIV infection.

Results

In total, 11 904 interviews were completed so that 77.2% (n = 11 904 of 15 414) of enumerated and eligible youth completed an interview; 12.6% refused to take part in the interview and 10.2% were not found at home after at least three visits on different days/times. Thirteen percent of households were not able to be enumerated after multiple visits so 68.2% of known eligible and estimated eligible (40% of un-enumerated households) youth completed an interview (n = 11 904/17 450).

Sociodemographics

The sociodemographic profile of the population is very similar to the South African population as the data were weighted to the 2001 census, thus the majority of youth were of Black African race (82%). Close to 47% were living in urban formal areas, 39% in rural informal areas, 8% in urban informal areas and 6% in rural formal areas. Close to 38% of those aged 20–24 years reported having completed high school and 74% of 15–19 year olds reported being in school. Slightly less than 3% of young women and 1.1% of males reported being married.

Nearly a quarter reported living in households without electricity.

HIV prevalence

Young women were significantly more likely to be infected with HIV in comparison with their male counterparts, namely 15.5% [95% confidence interval (CI), 13.7–17.6] among women and 4.8% (95% CI, 3.9–5.9) among men, $P < 0.01$ (Table 1). Among females, HIV prevalence rose from 4% among 15 and 16-year-old females to 31% among women age 21 years. Among males, HIV prevalence was relatively constant at 2–3% between ages 15 and 19 years and then steadily increased to 11–12% by age 23–24 years (Fig. 1). Among 20–24 year olds, nearly one in four young women was infected with HIV in comparison with 1 in 14 young men of the same age. Among those who reported never having had sex, 2.5% of males and 3.8% of females were HIV positive.

Sexual behavior

Forty-eight percent of 15–19 year olds reported ever having had sex (vaginal or anal) in comparison with 89% of 20–24 year olds, with no significant differences by

Table 1. Weighted proportions for HIV seroprevalence and related risk factors, and *P*-values of differences between males and females aged 15–24 years, South Africa, 2003.

	Males n = 5686	Females n = 6217	Chi-squared *P*-value
HIV positive	4.8	15.5	< 0.001
Mean number of lifetime sexual partners[a]	4.9	2.3	< 0.001[c]
Mean number of sexual partners in past 12 month[a]	1.8	1.1	< 0.001[c]
Used a condom at last sex[a]	56.8	48.0	0.07
Always used a condom with most recent partner[b]	39.2	28.6	0.003
Age of coital debut ≤ 14 years[a]	17.5	7.8	< 0.001
Unusual genital discharge in past 12 month[a]	9.2	19.2	< 0.001
Genital ulcers/sores in past 12 month[a]	5.9	6.9	0.2
Sex less than five times in past month[b]	92.1	90.0	0.07
Relationship length ≤ 1 month[b]	24.2	13.2	0.003
Length of time since coital debut > 12 month[a]	78.9	72.2	0.02
Partner type at last sex[b]			
Main partner[d]	82.3	98.5	< 0.001
Regular casual	12.4	0.4	
Non-regular casual	5.2	1.1	
Age difference with most recent partner[b]			
Same age or younger	88.2	9.7	< 0.001
1–4 years older	10.5	57.7	
5 or more years older	1.3	32.6	
Ever engaged in transactional sex[a]	3.5	2.1	0.02
Ever been physically forced to have sex[a]	2.0	9.6	< 0.001
Ever pregnant[a]		49.5	
Circumcised[a]	34.5		
Heard of or seen the loveLife campaign	84.0	85.2	0.7
Participated in at least one loveLife program	33.6	34.8	0.6
Participated in a youth group at least once in the past month	68.3	44.3	< 0.001
Reported behavior change because of HIV/AIDS	62.3	64.2	0.7
Ever been tested for HIV	14.7	24.7	< 0.001
Personally know someone who has died of AIDS	40.4	49.9	0.03

[a]Among those reporting ever having had sex, males (n = 3625) females (n = 4066).
[b]Among those who reported having had sex in the past 12 months, males (n = 3024) females (n = 3624).
[c]F test for difference in means.
[d]Main partner was defined as a husband or wife or main girlfriend/boyfriend. A regular casual partner was defined as someone other than the main partner or spouse that the participant has sex with on an on-going basis. A non-regular casual partner was defined as someone other than the main partner or spouse that the participant does not have sex with on an on-going basis, for example they only ever had sex one or two times with the partner.
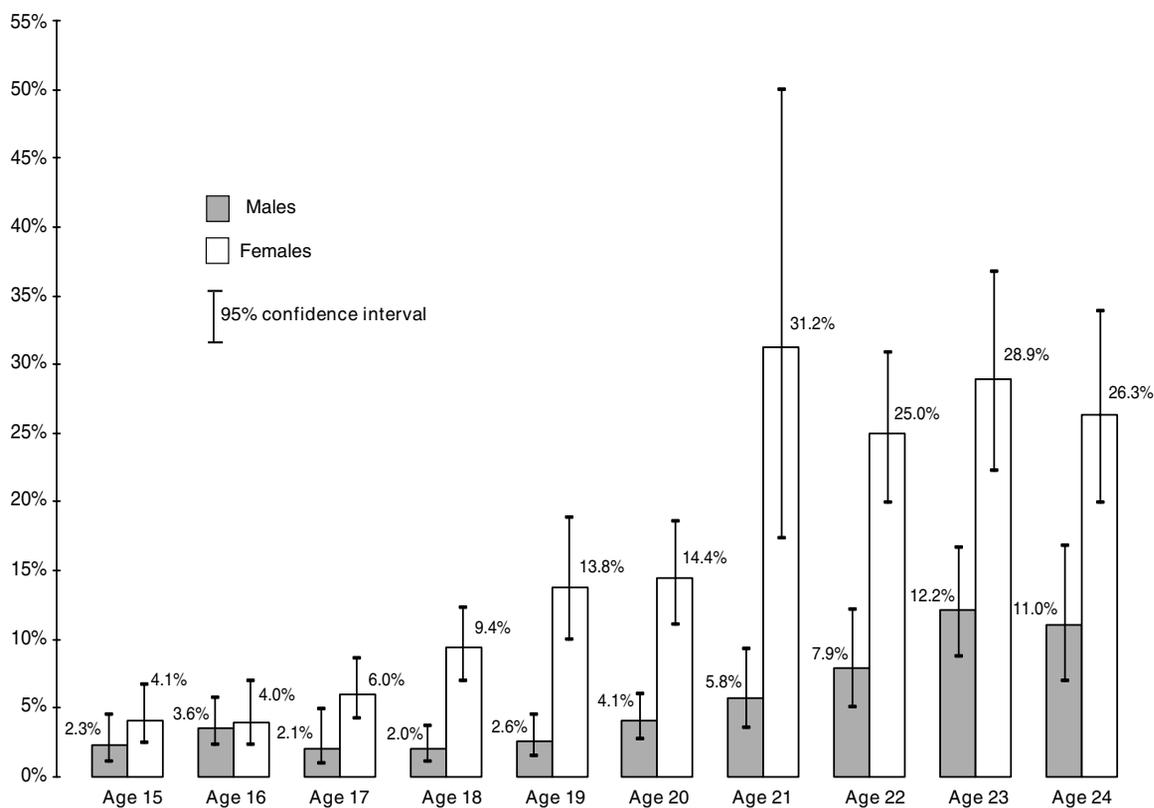
Fig. 1. HIV prevalence by age and sex among 15–24 year olds, South Africa, 2003.

gender. Among those who reported ever having had sex, 73% of 15–19-year-old men compared with 90% of young women of the same age reported having had sex in the past 12 months ($P < 0.001$); close to 84% of sexually experienced 20–24 year olds reported having had sex in the past 12 months and there were no significant differences by gender. Among sexually experienced young people, nearly 25% of males and 45% of females reported having had one lifetime sexual partner. Among sexually experienced youth, 57% of men and 48% of women reported that they used a condom at last sex, but the majority of both men and women reported that they did not always use a condom with their most recent sexual partner (61 versus 71%, $P < 0.001$ respectively) (Table 1). The majority of males and females reported that their most recent sexual partner was a main partner, although more men reported casual partners than females (17.6 versus 1.5%, $P < 0.001$) (Table 1).

Among sexually experienced females, 33% of 15–19 year olds and 59% of 20–24-year-old women reported ever having been pregnant. Fifty-two percent of sexually experienced women reported that they were currently using contraception. Approximately 9% of males and 19% of females reported having had an unusual genital discharge in the past 12 months and between 6 and 7% of males and females reported having had genital ulcers in the past 12 months (Table 1). Just over one-third of men reported being circumcised (Table 1).

Early coital debut (defined as age 14 years or younger) was reported by 17.5% of males and 7.8% of females (Table 1). The median age of first sex was 16 years for men and 17 years of women. Two percent of females and 3% of males reported ever having engaged in transactional sex [The question for transactional sex was asked in this way for both men and women: 'Have you ever had sex with someone so that they would give you material or any other kind of support such as money, presents, alcohol, food, clothes, better grades, transportation etc in exchange?'. Men were also asked separately about having given a woman any of these things in exchange for sex.] (Table 1). The age of sexual partners for men was reported to be approximately 1 year younger than themselves while for women their partners were on average 4 years older. Among sexually experienced youth, 2% of young men and close to 10% of young women reported that they had ever been physically forced to have sex (Table 1).

HIV prevention behaviors
Close to 85% of men and women reported awareness of the loveLife youth HIV prevention program and more than one-third of youth reported that they had actually participated in one of the loveLife programs (Table 1). Nearly one-quarter of women and close to 15% of men reported that they had ever been tested for HIV (Table 1) and 15% of women and 7% of men reported knowing their HIV status. Encouragingly, over 60% of men and

Table 2. Unweighted counts and weighted HIV prevalence, 95% confidence interval (CI) and unadjusted odds ratios for sexually experienced men and women ages 15–24 years by key HIV risk factors.

	Men %HIV+ (95% CI) 5.9 (4.8–7.4)	Unweighted *n*	Unadjusted odds ratio	Women %HIV+ (95% CI) 21.1 (18.7–23.7)	Unweighted *n*	Unadjusted odds ratio
Race						
Black African	6.4 (5.0–8.1)	203/3102	2.0 (1.0–4.0)	23.3 (20.7–26.1)	763/3573	7.7(4.4–13.8)
Other	3.2 (1.8–5.9)	18/524	1.0	3.8 (2.2–6.4)	25/493	1.0
Place of residence						
Urban	6.9 (5.5–8.6)	134/1911	1.5 (0.9–2.4)	23.0 (19.9–26.3)	428/2064	1.3 (0.9–1.8)
Rural	4.7 (3.1–7.0)	87/1714	1.0	19.0 (15.2–23.4)	360/2002	1.0
Marital status						
Married (legal or traditional)	11.4 (4.0–28.5)	6/45	2.1 (0.6–6.5)	11.0 (7.0–17.0)	28/199	0.4 (0.3–0.8)
Single	5.8 (4.7–7.3)	215/3580	1.0	21.5 (19.1–24.2)	760/3865	1.0
Ever had sex						
Yes	5.9 (4.8–7.4)	221/3626	2.4 (1.7–3.4)	21.1 (18.7–23.7)	788/4066	6.8 (4.8–9.3)
No	2.5 (1.8–3.6)	56/2058	1.0	3.8 (2.9–5.1)	86/2149	1.0
Lifetime no. sex partners						
1	3.8 (2.2–6.4)	35/889	1.0	15.0 (9.7–22.6)	205/1708	1.0
>1	6.6 (5.4–8.1)	185/2727	1.8 (1.0–3.1)	26.1 (22.5–30.1)	582/2350	2.0 (1.1–3.7)
Sex partners in past 12months						
1	7.0 (5.4–9.0)	97/1720	1.0	19.2 (16.1–22.8)	611/3160	1.0
>1	6.4 (5.0–8.1)	94/1304	0.9 (0.6–1.3)	23.0 (16.6–31.0)	95/464	1.2 (0.8–1.8)
Condom use at last sex						
Yes	4.9 (3.9–6.1)	119/2208	1.0	16.7 (13.3–20.8)	355/1953	1.0
No	7.3 (4.9–10.7)	100/1415	1.5 (0.9–2.5)	25.1 (19.5–31.6)	433/2110	1.7 (1.0–2.8)
Condom use consistency						
Always	4.6 (3.4–6.2)	64/1199	1.0	14.7 (10.5–20.2)	159/970	1.0
Sometimes/Never	8.1 (6.3–0.2)	126/1809	1.8 (1.2–2.7)	21.8 (18.4–25.6)	544/2636	1.6 (1.1–2.4)
Age of coital debut						
≤ 14 years	3.8 (5.2–7.7)	30/556	0.6 (0.3–1.1)	20.8 (15.1–27.8)	77/382	1.0 (0.6–1.5)
> 14 years	6.3 (2.0–7.2)	189/3062	1.0	21.1 (18.5–24.0)	711/3681	1.0
Unusual genital discharge past 12 months						
Yes	11.7 (7.6–17.6)	34/323	2.3 (1.4–3.8)	29.0 (22.4–36.8)	208/754	1.7 (1.1–2.7)
No	5.3 (4.2–6.7)	186/3290	1.0	19.2 (16.2–22.5)	579/3305	1.0
Genital sores/ulcers in past 12 months						
Yes	12.8 (8.3–19.3)	28/225	2.5 (1.5–4.2)	20.6 (14.8–27.8)	70/298	1.0 (0.6–1.4)
No	5.5 (4.3–6.9)	192/3385	1.0	21.2 (18.7–23.9)	717/3750	1.0
Sex frequency in past mo.						
≤ 5 times	6.1 (5.0–7.5)	163/2762	1.0	19.6 (16.3–23.4)	612/3201	1.0
> 5 times	13.4 (8.4–20.6)	25/230	1.5 (1.1–2.0)	21.8 (16.5–28.2)	88/375	1.1 (0.8–1.6)
Relationship length						
≤ 1 month	3.7 (2.4–5.6)	32/766	1.0	13.8 (8.3–21.9)	71/460	1.0
> 1 month	7.5 (6.0–9.3)	150/2172	2.1 (1.3–3.5)	20.4 (17.4–23.8)	618/3085	1.6 (1.0–2.6)
Partner type at last sex						
Main partner	7.0 (5.6–8.6)	160/2505	1.0	19.6 (16.5–23.2)	688/3546	1.0
Regular casual	6.3 (3.7–10.8)	23/353	0.5 (0.2–1.1)	27.9 (12.3–51.5)	12/46	0.6 (0.1–2.5)
Non–regular casual	3.5 (1.5–7.6)	7/152	0.9 (0.5–1.7)	12.3 (3.2–37.6)	3/20	1.6 (0.6–4.4)
Age difference w/partner						
Same age or younger	6.5 (5.3–7.9)	164/2662	1.0	16.7 (11.0–24.6)	49/333	1.0
1–4 years older	7.5 (4.4–12.5)	21/307	1.2 (0.6–2.1)	17.8 (13.8–22.5)	345/2005	1.1 (0.6–1.9)
≥ 5 years older	12.9 (3.7–36.0)	4/31	2.1 (0.5–8.2)	24.2 (20.5–28.5)	302/1421	1.6 (1.0–2.6)
Transactional sex ever						
Yes	4.7 (2.0–10.6)	7/121	0.8 (0.3–1.9)	26.3 (14.4–43.0)	25/96	1.3 (0.6–2.9)
No	6.0 (4.8–7.4)	214/3503	1.0	20.9 (18.5–23.6)	763/3970	1.0
Time since coital debut						
> 12 months	6.5 (5.2–8.4)	192/2671	2.9 (1.2–3.5)	26.2 (23.0–29.7)	678/2899	4.2 (2.7–6.5)
≤ 12 months	3.4 (2.1–5.4)	27/946	1.0	7.8 (5.5–10.8)	110/1164	1.0
Ever forced to have sex						
Yes	4.7 (1.6–13.0)	4/67	0.8 (0.2–2.4)	22.3 (16.2–29.9)	86/380	1.1 (0.7–1.6)
No	6.0 (4.8–7.4)	217/3558	1.0	20.9 (18.4–23.7)	702/3686	1.0
Ever pregnant						
Yes	–	–	–	23.6 (19.7–28.0)	478/2028	1.3 (0.8–2.2)
No	–	–	–	18.6 (14.0–24.4)	308/2028	1.0
Circumcised						
Yes	4.5 (3.0–6.7)	62/1236	0.6 (0.4–1.0)	–	–	–
No	6.7 (5.4–8.3)	157/2362	1.0	–	–	–
Have seen or heard loveLife						
Yes	6.1 (4.9–7.6)	199/3139	1.3 (0.7–2.6)	21.3 (18.9–24.0)	632/3307	1.1 (0.8–1.6)
No	4.7 (2.5–8.8)	22/486	1.0	19.7 (14.8–25.6)	156/759	1.0

Table 2. (continued)

	Men %HIV+ (95% CI) 5.9 (4.8–7.4)	Unweighted n	Unadjusted odds ratio	Women %HIV+ (95% CI) 21.1 (18.7–23.7)	Unweighted n	Unadjusted odds ratio
Participated in loveLife programs						
Yes	4.8 (3.6–6.3)	78/1365	0.7 (0.5–1.1)	15.9 (12.1–20.6)	200/1263	0.6 (0.4–0.9)
No	6.5 (4.9–8.6)	413/2261	1.0	23.5 (19.4–28.2)	588/2803	1.0
Participated in a youth group at least once in the past month						
Yes	5.7 (4.3–7.7)	181/3693	0.9 (0.6–1.2)	9.5(7.4–12.1)	280/2746	0.4(0.2–0.7)
No	6.4 (4.8–8.4)	96/1714	1.0	20.4(16.4–25.0)	593/3469	1.0
Behavior change due to HIV/AIDS						
Yes	6.0 (4.9–7.4)	168/2665	1.1 (0.6–1.9)	21.9 (19.1–25.0)	567/2774	1.2 (0.9–1.6)
No	5.7 (3.4–9.4)	52/942	1.0	19.0 (15.6–23.0)	220/1283	1.0
Ever been tested for HIV						
Yes	9.2 (6.5–13.1)	56/621	1.8 (1.2–2.9)	24.1 (20.1–28.2)	290/1259	1.3 (0.9–1.9)
No	5.2 (4.1–6.7)	164/2988	1.0	19.6 (16.1–23.6)	497/2799	1.0
Know someone who died of AIDS						
Yes	7.3 (5.6–9.3)	123/1709	1.5 (1.0–2.4)	24.1 (20.6–28.1)	454/2128	1.5 (1.2–2.0)
No	4.8 (3.4–6.7)	97/1899	1.0	17.2 (14.7–20.1)	333/1931	1.0

women reported that they had changed their behavior because of HIV/AIDS (Table 1).

Predictors of HIV infection

Bivariate associations between HIV prevalence and potential risk factors, by gender, are presented in Table 2. Table 3 presents sexual behaviors and biological factors identified as being significantly associated with HIV infection in simultaneous multiple logistic regression among sexually experienced young people. Among males, one of the strongest factors associated with HIV infection was reported genital ulcers in the past 12 months [adjusted odds ratio (AOR) 1.91; 95% CI, 1.04–3.49]. Genital ulcers were not significantly associated with HIV for women, but women who reported unusual vaginal discharge in the past 12 months were 1.8 (95% CI, 1.3–2.4) times more likely to be infected with HIV in

comparison with women without discharge. Young women aged 15–19 years whose sexual partner was 5 or more years older and women aged 20–24 years whose partners were 1 to 4 years older were significantly more likely to be infected with HIV in comparison with women with a partner the same age or younger (AOR, 3.2; 95% CI, 1.2–8.3; AOR, 2.3; 95% CI, 1.4–3.6, respectively) [Partner age difference could not be explored for men in the multivariable model as so few men had older partners.]. For each additional lifetime sexual partner the odds of HIV infection increased by 1.03 (95% CI, 1.01–1.06) times for men and 1.09 (95% CI, 1.01–1.16) times for women. Men who reported being circumcised were less likely to be infected with HIV than men who were not circumcised (AOR, 0.62; 95% CI, 0.39–1.00). Among men and women combined (data not shown), inconsistent condom use was

Table 3. Multivariable model examining the association between sexual behaviors, biological risk factors and socio-economic factors and HIV infection among sexually experienced men and women age 15–24 years in South Africa: Adjusted odds ratios (AOR), 95% confidence intervals (CI) and associated *P*-values for prevalent HIV infection from multiple logistic regression.

	Men		Women	
n	AOR (95% CI)	P-value	AOR (95% CI)	P-value
Black race (vs other)	2.61 (1.25–5.47)	0.01	8.33 (4.15–16.71)	< 0.01
Urban (vs rural)	1.96 (1.21–3.19)	0.01	2.16 (1.44–3.24)	0.01
Age 20–24 years (vs 15–19 years)	2.56 (1.69–3.88)	< 0.01	4.26 (1.43–12.70)	< 0.01
Married (vs single)	2.09 (0.63–6.95)	0.2	0.56 (0.32–0.96)	0.04
Did not complete high school (vs completed)	1.93 (1.22–3.06)	< 0.01	2.34 (1.71–3.21)	< 0.01
Sexually active for > 12 month (vs ≤ 12 months)	0.95 (0.54–1.69)	0.87	2.37 (1.65–3.39)	< 0.01
Number of lifetime sexual partners (per additional partner)	1.03 (1.01–1.06)	0.02	1.09 (1.02–1.17)	0.01
Did not always use a condom with most recent partner (vs always used)	1.40(0.88–2.23)	0.2	1.54 (1.05–2.26)	0.03
Age difference with most recent partner:				
15–19 years old: 1–4 years older (vs ≤ same age)	–	–	1.89 (0.66–5.47)	0.24
15–19 years old: ≥ 5 years older (vs ≤ same age)	–	–	3.22 (1.25–8.33)	0.02
20–24 years old: 1–4 years older (vs ≤ same age)	–	–	2.28 (1.45–3.59)	< 0.01
20–24 years old: ≥ 5 years older (vs ≤ same age)	–	–	1.40 (0.94–2.08)	0.09
Circumcised (vs not)	0.62 (0.39–1.00)	0.05	–	–
Had sex > 5 times in past month (vs ≤ 5 times)	1.69 (0.93–3.07)	0.09	1.03 (0.69–1.54)	0.90
Unusual genital discharge in past 12 months (vs none)	1.61 (0.90–2.88)	0.11	1.75 (1.26–2.44)	< 0.01
Genital ulcers in past 12 months (vs none)	1.91 (1.04–3.49)	0.04	0.67 (0.39–1.15)	0.15
Length of most recent sexual relationship ≤ 1 month (vs > 1 months)	0.59 (0.33–1.06)	0.08	1.16 (0.80–1.69)	0.44

Table 4. Multivariable model examining factors theorized to reduce HIV risk and HIV infection among sexually experienced men and women age 15–24 years in South Africa: Adjusted odds ratios (AOR), 95% confidence intervals (CI) and associated *P*-values for prevalent HIV infection from multiple logistic regression[a].

	Men		Women	
	AOR (95% CI)	*P*-value	AOR (95% CI)	*P*-value
Have participated in loveLife programs (vs have not)	0.60 (0.40–0.89)	0.01	0.61 (0.43–0.85)	< 0.01
Ever tested for HIV (vs have not)	1.87 (1.22–2.88)	< 0.01	1.24 (0.94–1.64)	0.13
Know someone who has died of AIDS (vs do not)	1.19 (0.77–1.83)	0.4	1.34 (0.98–1.83)	0.06
Participated in a youth group at least once in the past month (vs did not)	1.06 (0.70–1.60)	0.3	0.57 (0.31–1.07)	0.08

[a]Adjusted for completed high school or not, race, age, urban/rural residence, marriage, electricity in the home, awareness of two different national HIV prevention campaigns.

significantly associated with HIV infection (AOR, 1.41; 95% CI, 1.04–1.90). Youth of both sexes who were of Black African race, living in an urban area, who were older or who had not completed high school were all significantly more likely to be infected with HIV than youth who did not have these characteristics. Young women who reported being married (only 3% of the total sample) were significantly less likely to be infected with HIV.

Table 4 presents the multivariable model exploring the association between factors that are theorized to reduce HIV risk and HIV serostatus among sexually experienced youth. Both men and women who reported having participated in at least one loveLife program were significantly less likely to be infected with HIV (males: AOR, 0.60; *P* = 0.01 and females: AOR, 0.73; *P* < 0.01). Young women who reported having participated in a youth group at least once in the past month were also less likely to be infected with HIV, although the association was not significant. Men who reported having been tested for HIV were significantly more likely to be infected with HIV (AOR, 1.87; *P* = 0.01).

Discussion

South Africa is one of the countries in sub-Saharan Africa hardest hit by the HIV epidemic. This survey is the largest nationally representative household survey of HIV prevalence and detailed sexual behavior conducted among young people in South Africa to date. Our results confirm the magnitude of the HIV epidemic among the general population in South Africa and emphasize the enormous gender disparity in HIV prevalence among young men and women in this population. Further, the large sample size allows for detailed sub-analyses and provides valuable information on HIV prevalence in urban and rural areas of South Africa.

Women in this study were four times more likely to be infected with HIV in comparison with men of the same age. This gender inequality among young people has been noted in a number of surveys throughout sub-Saharan Africa [5–9]. In this survey, a number of sexual behaviors were identified that may partially explain women's increased risk of HIV. Women were significantly more likely to report using condoms inconsistently, to have relationships with older partners, to be in longer relationships with a main partner, and among 15–19 year olds, to have sex more often than their male counterparts.

Older male partners have been theorized to place young women at greater risk of HIV infection [6–8]. In this study we found that 15–19-year-old women with a partner 5 or more years older and women aged 20–24 years with a partner 1–4 years older were significantly more likely to be infected with HIV in comparison with women with a partner the same age or younger. Interestingly, for women of both age groups, male partners between the ages of 20 and 30 years appear to convey the greatest risk for HIV acquisition. This finding suggests that in a generalized epidemic, sexual mixing with partners who may be only a few years older, significantly increases the risk of HIV infection.

Pregnancy among sexually experienced young women in South Africa is high; close to one-third of 15–19 year olds and nearly two-thirds of 20–24 year olds reported having been pregnant. Among all young women pregnancy levels appear to have remained relatively constant; 15.5% of 15–19 year olds reported having been pregnant in this survey compared to 16.4% in the 1998 Demographic and Health Survey (DHS) [10]. The majority (66%) of pregnancies in this study were reported to be unwanted and yet only half of sexually active women reported that they were using contraception and reported abortion levels were low (3%) among women who reported to have ever been pregnant. The combination of high HIV prevalence and unwanted pregnancy highlights the unmet need for contraception, and in particular the importance of dual protection, in South Africa. Furthermore, although we did not find an association between pregnancy and HIV prevalence, recent data from Uganda demonstrating an increased risk of HIV acquisition during pregnancy [11] emphasizes the need for research to explore the role of pregnancy in HIV acquisition.

In countries where declines in HIV prevalence have been detected, associated declines in the number of sexual

partners and increases in condom use have been identified as important contributing factors [12–14]. The mean number of reported lifetime sexual partners among men in this survey was significantly higher than among females (7.2 versus 4.7, $P < 0.01$) although the majority of youth reported only having had one sexual partner in the past 12 months. Having more than one lifetime sexual partner significantly increased the risk of HIV infection. The role that partner concurrency may have to play in increasing HIV risk in this population should be explored in further research. Obviously, reduction in partner numbers should remain an important message for prevention programs.

Over 50% of participants reported having used a condom the last time they had sex, this is similar to levels found in a national survey conducted in 2002 [15]. Although national estimates of condom use before 2002 are scarce, condom use at last sex among women in the 1998 DHS was 16.6%, indicating that condom use may have increased substantially in the past 5 years [10]. Condom use consistency, however, was much lower. Seventy-seven percent of youth reported that they did not always use condoms with their last partner and these youth were more likely to be HIV infected in comparison with those who reported always using condoms. This finding underscores the importance of condom use consistency which seems necessary in order to have an impact on population HIV levels [16,17].

Self-reported unusual genital discharge and genital ulcers in the past 12 months were significant risk factors for HIV infection, after controlling for high-risk behavior and demographic characteristics. Other studies in Africa have found that self-reported symptoms of genital discharge and ulcers are associated with an increased risk of HIV infection [5,18,19]. It is important to note that STI presence was based on self-report which does not capture asymptomatic infections and may be subject to recall error.

Black South Africans were at significantly increased risk of HIV infection. This risk remained after controlling for socio-economic and sexual behavior variables, although it is very likely that residual confounding remains. Given the legacy of apartheid in South Africa, there are a multitude of socio-economic, social, behavioral and potentially biological factors that may contribute to the increased risk of HIV among Black South Africans in comparison with individuals of other races. It is important to note that response rates were significantly lower for other race groups (particularly for White youth) compared to Black youth therefore, higher risk youth of other races may not have been captured in this survey.

Exposure to the loveLife HIV prevention campaign close to 4 years after its launch was very high with 85% of respondents in the survey reporting awareness of the campaign. Over one-third of all youth reported that they

had participated in at least one of loveLife's programs. Sexually experienced youth who reported participating in loveLife programs were significantly less likely to be HIV infected in a multiple variable model, controlling for potential confounders. As this survey is cross-sectional, determining the causal sequence of events regarding participation in loveLife programs and HIV infection is not possible; nevertheless, the present analysis is consistent with the hypothesis that the program is having an effect on HIV risk among young people. It is also possible that youth who participated in loveLife programs were systematically different than youth who did not participate with regard to their HIV risk profile. Determining the impact of a diverse national prevention campaign such as loveLife is difficult, and changes in HIV prevalence over time will result from the combined effect of many prevention initiatives.

Given the cross-sectional nature of the study, sexual behavior in the past year may not be directly relevant to the individual's HIV status, or may even be the result of HIV infection. Nevertheless, given the nationally representative nature of the study and the large sample size, it provides valuable information for better understanding the scale and scope of the epidemic in South Africa. A limitation of all sexual behavior surveys rests in the nature of self-reported data. In spite of rigorous training of interviewers and measures taken to ensure privacy and reduce social-desirability bias, 2.5% of men and 3.8% of women who reported never having had sex were HIV positive. This has been found in other surveys of sexual behavior in Africa [9,20–22]. Despite this, the prevalence of self reported sexual behaviors in this survey are similar to two other large youth surveys that were conducted in South Africa in 2002 [15,23].

In conclusion, this survey confirms that HIV prevalence is high among young people in South Africa and, in particular, that young women are disproportionately at risk. Given the high prevalence of HIV among the general population in South Africa, sexual behaviors that might be deemed 'low risk' in low prevalence populations may place individuals at high risk of infection in this setting. Although it is possible that changes in sexual behavior may have been occurring in South Africa in the past few years, levels of protective behaviors are not yet high enough to have a significant impact on the epidemic. Factors that influence the probability of HIV transmission, such as STIs, and high-risk sexual behavior, such as having multiple lifetime sexual partners or older partners, were both found to be significantly associated with HIV infection. It is likely that none of the risk factors explored in this study act in isolation to increase HIV risk but rather work together. Programs for youth, including loveLife, must continue to promote partner reduction and consistent condom use while also addressing contextual factors, which undoubtedly contribute to risk but were not fully assessed here, that make it difficult for

youth, particularly young women, to implement behavior change (e.g. poverty, gender inequalities, social norms regarding HIV testing) and by strengthening interventions that reduce the probability of HIV transmission, such as improved access to STI treatment. This survey places South Africa in a unique position from which to monitor the HIV epidemic among the age group at greatest risk, most sensitive to change and among whom we are better able to estimate HIV incidence; repeating the survey over time will be invaluable in monitoring the effectiveness of the comprehensive program of prevention and care interventions being implemented at a national level in South Africa.

Contribution of authors

Audrey Pettifor was involved in conceptualizing the study, implementation, analysis of the data and took the lead in writing the paper. Helen Rees was also involved in study conceptualization, implementation and writing of the paper. Immo Kleinschmidt assisted in the sample design, statistical analysis, interpreting the results and writing of the paper. Annie Steffenson assisted in data analysis and interpretation of results, as well as assisting in writing the paper. Catherine MacPhail was engaged in writing and editing the paper. Lindiwe Hlongwa was involved in planning the study, supervision of fieldwork and reporting findings. Kerry Vermaak contributed through calculating and writing up the original response rate and Nancy Padian assisted in designing data collection instruments, interpreting results and writing the paper.

Acknowledgements

Role of the funding source

References

1. Joint United Nations Programme on HIV/AIDS. *2004 Report on the Global AIDS epidemic*. Geneva: UNAIDS; 2004.
2. Erb-Leoncavallo A, Holmes G, Jacobs G, Urdang S, Vanek J, Zarb M. *Women and HIV/AIDS: Confronting the Crisis*. Geneva: The Joint United Nations Programme on HIV/AIDS, The United Nations Population Fund, The United Nations Development Fund for Women; 2004.
3. Makubalo L, Netshidzivhani P, Mahlasela L, du Plessis R. *National HIV and Syphillis Antenatal Sero-prevalence Survey in South Africa 2003*. Pretoria: South African Department of Health; 2004.
4. Gallo D, George J, Fitchen J, Goldstein A, Hindahl M. **Evaluation of a system using oral mucosal transudate for HIV-1 antibody screening and confirmatory testing. OraSure HIV Clinical Trials Group.** *JAMA* 1997; **277**:254–258.
5. Obasi A, Balira R, Todd J, Ross D, Changalucha J, Mosha F, *et al*. **Prevalence of HIV and *Chlamydia trachomatis* infection in 15-19 year olds in rural Tanzania.** *Trop Med Int Health* 2001; **6**:517–525.
6. Laga M, Schwartlander B, Pisani E, Salif Sow P, Carael M. **To stem HIV in Africa, prevent transmission to young women.** *AIDS* 2001; **15**:931–934.
7. Gregson S, Nyamukapa C, Garnett G, Mason P, Zhuwau T, Carael M, *et al*. **Sexual mixing patterns and sex-differentials in teenage exposure to HIV infection in Zimbabwe.** *Lancet* 2002; **359**:1896–1903.
8. Glynn J, Carael M, Auvert B, Kahindo M, Chege J, Musonda RM, *et al*. **Why do young women have a much higher prevalence of HIV than young men? A study in Kisumu, Kenya and Ndola, Zambia.** *AIDS* 2001; **15**:S51–S60.
9. Auvert B, Ballard R, Campbell C, Carael M, Carton M, Fehler G, *et al*. **HIV infection among youth in a South African mining town is associated with herpes simplex virus-2 seropositivity and sexual behaviour.** *AIDS* 2001; **15**:885–898.
10. South African Department of Health. *South African Demographic and Health Survey 1998*. Pretoria: South African Department of Health; 2001.
11. Gray R, Serwadda D, Kigozi G, Wabwire-Mangen F, Brahmbhatt H, Wawer MJ. **Pregnancy and the risk of incident HIV in Rakai, Uganda, a cause for concern.** *Conference on Retroviruses and Opportunistic Infections*. Boston, 2005. Available at: http://www.retroconference.org/2005/cd/Abstracts/25618.htm
12. Fylkesnes K, Musonda R, Sichone M, Ndhlovu Z, Tembo F, Monze M. **Declining HIV prevalence and risk behaviours in Zambia: evidence from surveillance and population based surveys.** *AIDS* 2001; **15**:907–916.
13. Kamali A, Carpenter L, Whitworth J, Pool R, Ruberantwari A, Ojwiya A. **Seven-year trends in HIV-1 infection rates, and changes in sexual behaviour, among adults in rural Uganda.** *AIDS* 2000; **14**:427–434.
14. Bloom S, Banda C, Songolo G, Mulendema S, Cunningham A, Boerma T. **Looking for change in response to the AIDS epidemic: trends in AIDS knowledge and sexual behaviour in Zambia, 1990 through 1998.** *J Acquir Immune Defic Syndr* 2000; **25**:77–85.
15. Shisana O, Simbayi L. *Nelson Mandela/HSRC Study of HIV/AIDS South African National HIV Prevalence, Behavioural Risks and Mass Media Household Survey 2002*. Cape Town: Human Sciences Research Council; 2002.
16. Lagarde E, Auvert B, Chege J, Sukwa T, Glynn JR, Weiss HA, *et al*. **Condom use and its association with HIV/sexually transmitted diseases in four urban communities of sub-Saharan Africa.** *AIDS* 2001; **15 (Suppl 4)**:S71–S78.
17. Ahmed S, Lutalo T, Wawer M, Serwadda D, Sewankambo N, Nulugoda F, *et al*. **HIV incidence and sexually transmitted disease prevalence associated with condom use: a population study in Rakai, Uganda.** *AIDS* 2001; **15**:2171–2179.

18. Quigley M, Munguti K, Grosskurth H, Todd J, Mosha F, Senkoro K, *et al.* **Sexual behaviour patterns and other risk factors for HIV infection in rural Tanzania: a case–control study.** *AIDS* 1997; **11**:237–248.

19. Carpenter L, Kamali A, Payne M, Kiwuuwa S, Kintu P, Nakiyingi JS, *et al.* **Independent effects of reported sexually transmitted infections and sexual behaviour of HIV-1 prevalence among adult women, men and teenagers in rural Uganda.** *J Acquir Immune Defic Syndr* 2002; **29**:174–180.

20. Glynn J, Buve A, Carael M, Musonda RM, Kahindo M, Macauley I, *et al.* **Factors influencing the difference in HIV prevalence between antenatal clinic and general population in sub-Saharan Africa.** *AIDS* 2001; **15**:1717–1725.

21. Buve A, Lagarde E, Carael M, Rutenberg N, Ferry B, Glynn J, *et al.* **Interpreting sexual behaviour data: validity issues in the multicentre study on factors determining the differential spread of HIV in four African cities.** *AIDS* 2001; **15**: S117–S126.

22. Konde-Lule J, Wawer M, Sewankambo N, Serwadda D, Kelly R, Li C, *et al.* **Adolescents, sexual behaviour and HIV-1 in rural Rakai district, Uganda.** *AIDS* 1997; **11**:791–799.

23. Reddy S, Panday P, Swart D, Jinabhai C, Amosun S, James S, *et al.* **Umthenthe Uhlaba Usamila – The South African Youth Risk Behaviour Survey 2002.** Cape Town: South African Medical Research Council; 2003.