Measuring the impact of HIV and STIs in a community in a coal mining town, Mpumalanga, South Africa

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Synopsis

Background: A cross-sectional study was conducted in November 2001 to establish the prevalence rates of Human Immunodeficiency Virus (HIV) and sexually transmitted infections (STIs) (*Chlamydia trachomatis* and *Neisseria* gonorrhoea) in a coalmining town in Mpumalanga.

Methods: 155 adults were recruited (79 males and 76 females), by holding community meetings, and by door-to-door recruitment. Saliva and urine specimens were collected for the analysis of HIV and STI prevalence, respectively.

Results: The mean age for males was 31.35 years (min = 19 yrs and max = 50 yrs) and the mean age of the female participants was 31.90 years (min = 17 yrs, max = 49 yrs). The prevalence of HIV was found to be 22.78% [95% CI (14.09–33.59)] in the males vs. 47.37% [95% CI (35.79–55.16)] in the females, [p = 0.001, OR = 3.05, 95%CI (1.49–6.26)]. The prevalence of *C. trachomatis* was 7.90% [95% CI (2.95–16.39)] in the males vs. 12.86% [95% CI (6.05–23.00)] in the females, p = 0.324. The prevalence of *N. gonorrhoea* was 3.79% [95% CI (0.79–1.08)] in the males vs. 9.86% [95% CI (4.06–19.26)] in the females, p = 0.137. HIV was significantly associated with *C. trachomatis*, [p = 0.032, OR = 3.18, 95% CI (1.04–9.72)], but was not significant when stratified by gender. HIV was not significantly associated with *N.gonorrhoea* (p = 0.072) but it was significantly associated when stratified by gender, p = 0.001 for females. There were no significant associations between HIV and age (p = 0.408), even upon stratification by gender.

Conclusions: HIV prevalence in this community is high, and corresponds to national figures. However, the prevalence of STIs is surprisingly low as it would be expected to be high in a migrant population. Although communities are exposed to expanding peer-education activities that encourage behaviour change, the prevalence of HIV in this group. There is an urgent need for interventions designed to treat or prevent HIV infection in women generally and in women at high risk.

Keywords: HIV prevalence, STI prevalence, antenatal, mining

Introduction

South Africa has experienced one of the fastest-growing HIV epidemics in the world. Data from antenatal clinics have shown an increase in the prevalence of HIV from 0.7% in 1990 to 27.9% in 2003, with some evidence of levelling off[1]. The World Health Organization (WHO) and UNAIDS estimate that more than 5 million South Africans are infected with the HI virus and about 1 000 people die every day from AIDS-related complications[2].

The mining industry in South Africa, which has been heavily dependent on a migrant labour system for the last century or so[3], has been the subject of large biomedical and behavioural interventions, targeting the disease burden associated with the living and working conditions of mine employees[3]. Diseases such as silicosis can be attributed directly to working conditions, while others, such as HIV infection, require much more complex interventions. In addition to silicosis and HIV infection, these migrant communities suffer from high levels of sexually transmitted infections[3]: in a study in Carltonville, a random sample of 228 mine workers indicated rates for syphilis, chlamydia and gonorrhoea were 4.6%, 6.7% and 8.1% respectively[4]. Sexually transmitted infections predispose individuals to infection with HIV and increase morbidity among infected individuals; they also contribute to the spread of the HIV epidemic on the mines[3].

The Powerbelt AIDS project, initiated in December 2000, is a partnership between the coalmining industry and associated industries, the municipalities of eMalahleni and Govan Mbeki, and the Provincial Department of Health in Mpumalanga. The Powerbelt Committee commissioned a study to measure HIV seroprevalence and the burden of STIs in two communities in which coalminers employed in the province's coalfield reside. The project is ongoing and is aimed at implementing social and behavioural prevention measures to curb the spread of HIV and STIs, at caring and supporting the infected and affected, and at socially uplifting the communities.

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Methodology

Sampling techniques

The study population consisted of adults (males and females) over the age of 17 years, living in a coalmining town in Mpumalanga. The sample size was calculated using Stat Calc, EPI Info Version 6.04d. A 24.5% expected frequency of HIV (SA National Antenatal Survey, 2000[6]) and a 7% precision (95% CI) were used to calculate a sample of 155. The study team met with community leaders at a community meeting with the specific aim of recruiting study volunteers who would want to be part of this survey. The volunteers were then asked to extend the recruitment drive to households within the community. Sampling was non-randomized and this limited the potential for generalizability.

Laboratory procedures

Saliva specimens for an Elisa-based HIV antibody test were collected using the Orasure® collection devices in combination with Vironostika HIV Uni-Form II, plus O Elisa test kits to collect specimens for HIV testing. The sensitivity and specificity of the Orasure device when tested with the Vironostika EIA are 99% and 99% respectively[5]. The Orasure device has the advantage that it is relatively easy to obtain specimens for the analysis by the device and the specimens remain stable in ambient conditions for 21days after collection.

Urine was collected and transferred into collection tubes. Samples were marked by age and sex, and no name or personal identification parameters were taken. Urine ligase chain reaction tests were conducted to detect positivity for gonorrhoea and chlamydia[7,8].

Each participant received a card with a barcode number corresponding to their urine specimen. The card also provided information on when participants should return for the results of the urine tests for STIs. This was necessary as it was felt that participants with positive STI results would require follow-up for treatment of the STIs.

No blood specimens were taken, nor were other invasive techniques used. A total of 155 specimens was collected for testing.

All specimens were collected, transported, stored and tested using standard operating procedures and under the supervision and management of Clinical Laboratory Services. Clinical Laboratory Services has SANAS accreditation and well-integrated quality assurance schemes (both internal and external).

Data capturing, management and analysis

Laboratory data were given to HIV Management Solutions for data entry. All source documents were archived at HIV Management Solutions. Data were entered into Microsoft Excel spreadsheets, using a single data entry. They were then forwarded to the CSIR where data 'cleaning' and recoding were done. The data were exported, using Stat Transfer, into Stata Version 7[9] for basic and complex statistical analysis. There were no quality checks at the data-entry stage.

Basic $\chi 2$ tests were conducted to determine the association between categorical variables and other measured variables. Multiple logistic regression models were used to determine predictors of HIV by fitting all independent variables and interactions into the model.

Ethical consideration

The Wits committee for Ethical Clearance (University of the Witwatersrand, Faculty of Medicine) approved the standard subject information sheets used (Ref: 001109). These subject information sheets were translated into Sotho and Zulu, which are the predominant languages spoken in Mpumalanga. Subject information sheets were available to all participants on the days of testing. Written informed consent was not obtained as this survey was conducted using unlinked anonymous testing methodology, but verbal informed consent was obtained and the study participants were fully aware of why they were participating in the study and that they were under no obligation to participate in the study. The study participants were not given their HIV results but were provided with HIV educational and preventative material.

The study participants did receive feedback on their STI results, and those who tested positive were referred for treatment at the local health-care facility. A definite protocol for feedback on STI results was initiated at the local clinics[10]. Health-care facilities within this coalmining community agreed to treat participants who had tested positive for STIs according to the syndromic approach set out by the South African Department of Health[10].

Results

The mean age for the male participants was 31.35 years (SD 8.47) and the mean age for the female participants was 31.90 years (SD 7.46).

HIV prevalence was 22.78% [95% CI (14.09–33.59)] in the males versus 47.37% [95% CI (35.79–55.16)] in the females, [p = 0.001, OR = 3.05, 95%CI (1.49–6.26)]. HIV prevalence (64%) peaked at 21–25 years for the females and dropped (27%) in the 36–40 year age band. Male HIV prevalence (41%) peaked in the 31–35 year age band.

The prevalence of *C. trachomatis* was 7.89% [95% CI (2.95–16.39)] in the males versus 12.86% [95% CI (6.05–23.00)] in the females, p = 0.324. The prevalence of *N.gonorrhoea* was 3.79% [95% CI (0.79–1.07)] in the males versus 9.86% [95% CI (4.06–19.26)] in the females, p = 0.137.

HIV was significantly associated with *C. trachomatis* [p=0.032, OR=3.18, 95% CI (1.04–9.72)], but was not significant when stratified by gender. HIV was not significantly associated with *N. gonorrhoea* (p=0.072), but was significantly associated when stratified by gender (p=0.001 for females).

The effect of age did not differ across the strata for gender (p=0.734). There were no significant associations between HIV and age (p=0.408), even upon stratification by gender (p=0.200 for males and p=0.480 for females).

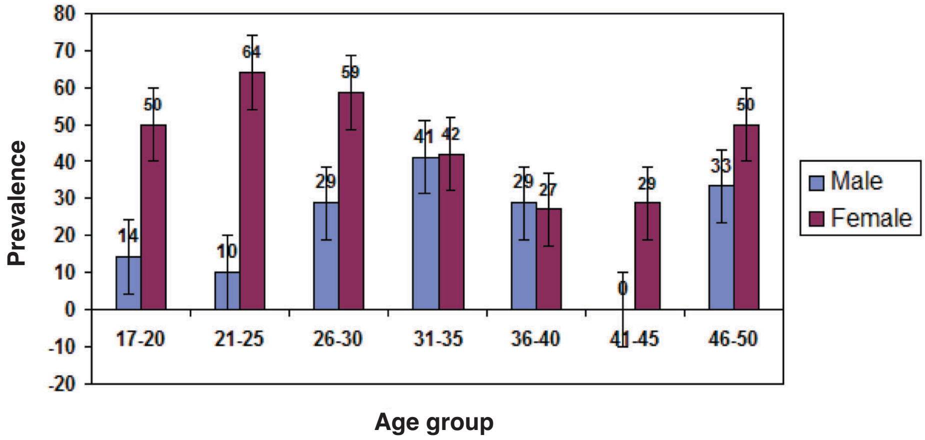

Figure 1—HIV Prevalence stratified by gender and age

Table I

Percentage distribution of HIV/STIs and age categorization

		Males (79)		Females (76)		
		%	95% CI	%	95% CI	P Value**
HIV prevalence		22.78	14.09–33.95	47.37	35.79–59.16	0.001*
STI prevalence	*N. gonorrhoea*	3.79	0.79–1.07	9.86	4.05–19.26	0.137
	C. trachomatis	7.89	2.95–16.39	12.86	6.05–23.00	0.324
Any STI		9.21	3.78–18.06	18.57	10.28–29.66	0.551
Age group						0.734
	min-20	47.62		52.38		
	21–25	43.26		56.74		
	26–30	39.26		60.74		
	31–35	43.05		56.95		
	36–40	39.29		60.71		
	41–45	52.29		47.71		
	46–50	47.92		52.08		

*Significance at 5% level
** Chi square test

Table II

Logistic regression model estimates for predictors of HIV

		Odds ratio	95% CI estimates
Gender	Female	10.44	2.21–49.21*
Age group	21–25	4.14	1.00–17.04*
	26–30	1.79	0.35–9.10*
Gender (26–30)		0.161	0.02–1.02
GPCR		2.34	0.59–9.19

Multiple logistic regression models were fitted to determine predictors for HIV. In this paper we present one model with significant and borderline associations. All independent variables and interaction variables, excluding *C. trachomatis*, which provided a less-than-adequate fit to the model, were included. Model selection was conducted using the equation:

Deviance = -2.Log Likelihood.

The odds for being HIV positive if individuals in the community are females are 10.44 [95% CI (2.21–49.21)] and 4.14 [95% CI (1.00–17.04)] if individuals are within the 21–25-year age group.

The model produced borderline significant results for predictors of HIV in the older age group of 26–30 and in gender within the same age group (26–30).

Individuals had an odds ratio of 2.34 [95% CI (0.59–9.19)] of being HIV positive if they were positive for *N. gonorrhoea*, although this was not significant at the 5% level.

Discussion

The prevalence of HIV in this mining community is high at 22.78% [95% CI (14.09–33.59)] for males, and 47.37% [95% CI (35.79–55.16)] for females, corresponding to studies previously conducted in mining communities[3,11]

In a study in Carltonville in which HIV prevalence among men and women was found to be 9.4 and 34.4% respectively, there was a positive Herpes Simplex Virus-2 (HSV-2) serology of 17.0 and 53.3% respectively[11]. HIV prevalence in 24-year-old women was 66.7% [95% CI (54.6–77.3]. HSV-2 seropositivity acted as a strong independent risk factor for HIV with odds of 5.3 for men and 8.4 for women[11]. The prevalence of gonorrhoea in Carltonville was measured to be 3.0% and 3.4% in the mineworkers and male residents of Khutsong respectively, and 6.9% and 5.7% in the female residents of Khutsong and women in 'hot spots' in the same area[3]. The prevalence of chlamydia was measured to be 3.8% and 5.2% in the mineworkers and male residents of Khutsong respectively, and 8.1 and 9.1 in the female residents of Khutsong and women in 'hot spots' in the same area[3].

The prevalence of STIs found in the present study is consistent with the findings in this gold mining community[3]. The prevalence of ulcerative STIs[12], in combination with aetiological diagnosis for urethral discharges, would have been a much more reliable indicator of HIV incidence if it had been determined.

The sample size was satisfactory for making inferences with regard to HIV prevalence in the population; however, we may add that the precision at which prevalence was calculated left a greater margin for error, as noted in the wide confidence intervals and larger standard errors (not presented) calculated for sample estimates. The method of selecting participants did not take into account any randomization or cluster techniques. Ideally, the optimum method of selecting participants would have been to use a cluster household randomized survey design that would have increased representivity[13].

Since selection bias cannot be controlled for, we will have to be careful in making generalizations about HIV prevalence in this specific community.

We must also note that mining communities are special populations in that there is a strong migrancy factor attached to them. Disease prevalence may vary according to the extent of migrancy among the population.

Response rates for the study were not measured. As we note with the Human Science Research Council (HSRC) community-based survey[14], large community surveys and health-care surveys suffer from major non-response bias or non-participation bias. We are not sure whether the population was sampled until the desired number had been reached (taking non-response into account) or whether allowance was made for over-sampling at the design stage of the study.

Studies of this nature must be modelled along guidelines on second-generation surveillance systems, designed by the WHO, UNAIDS and Family Health International[15]. This enables linked anonymous testing to be conducted in order to determine the relationship between HIV status and socio-demographic and behavioural practices. Data can then be used to design interventions and to enable forecasting of the epidemic and monitoring of epidemic curves.

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