Socio-Economic Characteristics of HIV in a South African Prison

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Abstract

South Africa has placed increased importance on addressing the HIV/AIDS epidemic and has identified people in prisons as one of several high risk groups. Despite this emphasis, respective departments have not pursued the task of data collection at all vigorously. A sample of 274 volunteer inmates was drawn from the Westville Maximum Security Prison, Durban, KwaZulu-Natal Province. A probit model was used and the data analysed to establish statistically significant risk factors for transmission of HIV and importantly the characteristics of those who are infected or not infected by HIV. The study found that sero-prevalence rates were significantly higher than the general population, and that the two socio-economic factors correlating to HIV/AIDS were ethnicity and age.

Keywords: Socio-Economics, South Africa, Prisons, HIV, Health

1. Introduction, Background and Research Problem

The identification and treatment of HIV/AIDS in prison populations has received increasing attention from multilateral institutions and national governments alike. For example, the World Health Organization's Regional Office for Europe 'Health in Prisons Project' was initiated in 1995, partially due to the recognition of the gap between public health on the one hand and prison health on the other; also with the recognition that communicable diseases, in particular HIV/AIDS, have higher prevalence rates in prisons than in the broader community (WHO, 2009). This has resulted in a series of comprehensive studies emphasizing prescriptive methods for the management of diseases, including HIV/AIDS. These prescriptions have rested on the observation that while the availability of antiretroviral therapy has 'changed HIV from a fatal disease to a manageable chronic condition', 'cure is not possible'; moreover 'therapy remains expensive' and in particular 'prevention remains vital' (WHO, 2007, 50-51; WHO/UNAIDS, 2006).

In the South African context, recognition of HIV/AIDS as a national problem, the depth of which is difficult to overstate, has resulted in a significant effort on the part of government. The publication of two national Strategic Plans for HIV/ AIDS, the first in 2000 (Department of Health, 2000) the second in 2007 (Department of Health, 2007) has accompanied a plethora of other work marshalled principally by the Department of Health, the most important of which are the biannual national HIV and syphilis antenatal sero-prevalence surveys, conducted since 2002 (Department of Health, n.d.). Further, the *National Strategic Plan 2007-2011* identified four 'Key Priority

Areas', namely [i] 'Prevention'; [ii] 'Treatment, Care and Support'; [iii] 'Research, Monitoring and Surveillance' and [iv] 'Human Rights and Access to Justice'. It also identified no less than eleven 'populations at higher risk', of which 'people in prisons' was one (Department of Health, 2007).

For its part, the South African Department of Corrective Services (DCS) has recognized the problem of HIV/AIDS amongst the incarcerated population. However, the rhetoric of the DCS has not matched that of national government. For example, the 2004 *White Paper* did not recognize prisoners with HIV/AIDS as a 'special category' of offender (although women, children, elderly offenders, offenders with mental illnesses and foreign nationals were all listed as special categories, amongst others). Indeed, the *White Paper* was long on the history of prisons in South Africa, but devoted a mere half-page to the specific problem of HIV/AIDS (DCS, 2004). Since that time, the DCS has not produced any comprehensive policy documents on HIV/AIDS, despite reports addressing other areas of concern, including a comprehensive *National Offender Population Profile* in June 2009 (DCS, 2009). Further, in successive *Annual Reports*, HIV/AIDS has been categorized as just one of several issues assessed for performance. In the *Annual Report 2008/09*, HIV/AIDS is the subject of one strategy, as represented in Table 1.

Insert Table 1 here

Examining Table 1 we can see that while a large number of prisoners participated in HIV/AIDS educational programs, this nevertheless constituted only 45 per cent of the total incarcerated population as at 30 June 2009 (DCS, 2009). Moreover, while the Department achieved its targets for both the implementation of comprehensive HIV/AIDS programs and services, these were only 50 per cent and 20 per cent of the population overall. Perhaps more striking, however, is the complete lack of sero-prevalence data for even a sample of the prison population. The Department has provided an amassed array of statistics on those they are responsible for, yet this has not included sero-prevalence rates, despite the announcement of the approval of an HIV/AIDS prevalence survey, for both prisoners and staff, by the DCS in 2006 (Reouf, 2006). This general lack of information stands in stark contrast with both the National Plan for the general population (inclusive of its identification of prisoners as one of eleven high risk cohorts) and the international literature of HIV/AIDS and prisons.

Recent studies have included an examination of challenges to providing support groups for HIV-positive prisoners (Rohleder, 2008), and an analysis of prisoners' and health care workers' perceptions of health care services (Sifunda, et al. 2006) as well as a general recognition of the gravity of the problem (Schalkwyk, 2005). Rohleder (2008) noted the nature of the high risk environment for the transmission of HIV/AIDS in South African prisons, citing the prevalence of tattooing, male rape associated with gang activities in prisons, the commodification of sex, where 'a poorer prisoner with no money may sell himself as a passive sex partner of a richer, more powerful prisoner', alongside consensual, unprotected sex as factors contributing to the high risk environment ('as condoms have not been readily available in prison, the occurrence of unprotected sex is high' (Rohleder, 2008, 281). Yet the *National Strategic Plan 2007-2011* expressly stated that 'little is known about the extent of HIV in South African correctional services, nor the relationship between known risk factors and HIV acquisition in South Africa' (Department of Health, 2007). As such, knowledge of HIV/AIDS in South African prisons remains inferential and speculative, rather than informative.

The initial purpose of this study therefore was to perform unlinked, anonymous, voluntary HIV testing on a sample of the prison population. A secondary and equally important purpose was to enable valuable information about the socio-economic characteristics of HIV/AIDS in prison to be collected. Thus, this paper has two aims. First, to report HIV infection levels for a sample of prisoners in a prison in Durban, KwaZulu-Natal, South Africa. Second, to report the socio-economic characteristics of the sample prisoner population who participated in the HIV screening program.

2. Methods

2.1 Study Site

A cross-sectional HIV prevalence study was conducted among the male inmates of the Westville Maximum Security Prison, Durban, KwaZulu-Natal Province, South Africa. Permission to conduct the study was obtained from the Department of Correctional Services and the research protocol was approved by the Ethics Committee of the University of KwaZulu Natal, Durban.

2.2 Sampling Procedure and Sample Size

Inmates from a division of the prison that accommodates 1,700 men were informed about the study by the prison authorities and were asked to volunteer. Because of the administrative procedures used in the prison it was not possible to recruit inmates cell by cell. This would have allowed calculation of participation rates. Instead, the

first 274 volunteers were recruited. The study consisted of an anonymous, unlinked sero-survey of a sample population in order to determine HIV prevalence. In addition to the HIV testing, the prisoners were given a questionnaire to gather data on high risk behaviour prior to, and during incarceration in order to understand the nature and extent of HIV transmission within the prison as well. All testing was done anonymously.

For a confidence of 95%, the sample size needed to be 60 for a population of 1,700. For a confidence of 99%, the sample size needed to be 103. The sample size of 274 meant that the confidence rate for the study was over 99%. Nevertheless, it has to be emphasized that this was a volunteer study with relatively low participation rates, entailing that the results must be interpreted with caution as one cannot be sure that the volunteers are truly representative of the entire prison population.

2.3 Interview

After being informed about the study in groups of about 10 to 20 people at a time, the prisoners were again informed that participation was voluntary and each volunteer signed a consent form and was interviewed privately. Demographic data and information on high-risk behaviour and knowledge of HIV was collected by means of a structured interview with the prisoner when the specimen was collected. The questionnaire obtained demographic data, information on sexual practices and drug practices as well as the reasons for incarceration. Urine specimens were obtained and tested at the University of KwaZulu Natal, Durban. HIV was diagnosed on a single positive ELISA test. The data was captured and analysed to establish statistically significant risk factors for transmission of HIV and importantly the characteristics of those who are infected and uninfected by HIV.

2.4 The Model

A probit model for binary choice of HIV positive or negative was used. The aim of the estimation was to test for statistically significant relationships between selected socio-economic variables of interest, namely income, education, ethnicity, marital status and HIV status in South African prisoners.

The estimated model took the form of HIV status = f (Ethnicity, Age, Income, Education).

2.5 Variables

- Age: A range variable, it indicated in which range the individual lies. The value following the first underscore indicates the lower bound, while the value following the second underscore indicates the upper bound. Bounds were always of the form greater/less than or equal to ($\geq$, $\leq$), never just greater/less than ($>$, $<$). In the sample, age ranges from 18 to 68.

- Ethnicity: A binary variable, thus participants were scored 1 if ethnicity was 'Black', 0 otherwise; 1 if ethnicity was 'Indian', 0 otherwise and 1 if ethnicity was 'Coloured' 0 otherwise.

- Education: A binary variable, equal to 1 if the individual has a post school educational qualification, 0 otherwise.

- Marital Status: A binary variable, 1 if marital status is married, 0 otherwise. 1 if marital status is cohabitating, 0 otherwise, 1 if marital status is single, 0 otherwise and 1 if marital status is divorced, 0 otherwise.

- Income: A continuous variable which reflects the sum of the total reported income from all sectors of income earning activity both legal and illegal.

3. Results

3.1 Demographic

Questionnaires and urine specimens were obtained from 274 prisoner volunteers. The ages of the participants ranged from 18 to 67 years, with a mean age of 30.6 years. A total of 127 (46.4 per cent) had no formal schooling and only 15 (5.5 per cent) had a post-matric diploma or degree. In the year prior to incarceration 108 prisoners (39.4 per cent) claimed to be in formal employment and 124 (45.3 per cent) were informally employed with 18 (6.6 per cent) obtaining income from selling drugs and a further 57 (20.8 per cent) obtaining money from other illegal sources. All participants were South African citizens and 249 (90.9 per cent) were black with the remainder being Indian (4.7 per cent), coloured (2.9 per cent) and white (1.9 per cent).

Insert Table 2 here

3.2 HIV Prevalence

271 out of 274 individuals provided usable specimens. 80 (29.6 per cent; 95 per cent C.I. 24.5 – 35.5) were infected with HIV. The prevalence was higher among those self-described as ethnically black (77/247 or 31 per cent) than among other ethnic groups (3/24 or 13 per cent) but this was of borderline statistical significance

(p=0.056). The number of observations for other individual ethnic groups was too small to allow comparisons with the general population.

Insert Table 3 here

According to the *National Strategy for HIV/AIDS 2007-2011*, the prevalence rate for HIV in South Africa generally at the time of the study was 24.8 per cent (Department of Health, 2007). The observed black prison population HIV infection rate was higher than the general population. This confirms the increased risk of HIV transmission in prisoner populations.

Insert Table 4 here

At the time of the study, prevalence by age in South Africa was 15.4 per cent for those under 20 years, 28.4 per cent in the 20-24 cohort, 31.4 per cent in the 25-29 cohort, 25.6 per cent for 30-34 cohort and 19 per cent for those aged 35-39 years. Table 4 indicates the high risk nature of those prisoners under the age of 40. All prisoner age groups had much higher rates of HIV than the community.

3.3 Other variables

The prevalence of HIV was lowest in individuals with no education (10/42 or 23.8 per cent) compared to those with primary school education (24/77 or 31.1 per cent) and those with a secondary school education (46/152 or 30.2 per cent). However, these differences were not statistically significant (p=0.671). Married men had a lower prevalence of HIV (5/29 or 17.2 per cent) than single people (61/202 or 30.2 per cent) and men living with partners (12/29 or 41.4 per cent). Again, however, this was not statistically significant (p=0.133).

3.4 Probit Model Estimates

Insert Table 5 here

The explanatory variables in this model specification appeared mostly more significant. After extensive effort, it was found that age and ethnicity were significant explanatory variables in this regard, with income significant as well. Variables such as marital status, different levels of education and others omitted from the model were shown consistently to be insignificant. Although coefficients cannot be interpreted directly to yield the magnitude of the influence each variable exerts on the probability of an individual being HIV positive, larger coefficients do mean larger influence with signing means what it usually does. Thus, we can see that this model estimates a fairly significant relationship between age, ethnicity, income and HIV status. Education level appears to be negative, but also highly insignificant in explaining HIV status in the sample.

Ethnicity was the dominating variable which determined HIV status. Whites were the least likely to be HIV positive – in fact this characteristic should perfectly predict HIV=0 where the individual is known to be white. Indians were the next least likely to be HIV positive (1/11). Coloured's were the next least likely to be HIV positive (1/3). Blacks were the most likely to be HIV positive (45.3%). Age was the next most significant variable. As expected by data for the national population, those who are younger are more likely to be HIV positive, with a significant risk for those aged 18 to 39, though decreasing over that age range as prisoners got older.

The income coefficient was small, yet significant. This magnitude was most likely for two reasons. First, the pervasiveness of HIV/AIDS in South Africa, with income providing very little protection against infection, thus the income variable's value only has a small influence upon the probability of being HIV positive. Second, the range of the income variable's value was 0 to Rand 140,000 per month. This large range meant much smaller marginal effects than would (normally) be the case than with an explanatory variable with a much smaller range. Plainly stated, an extra Rand is not going to exert a very potent influence upon the probability that a person is HIV positive or not.

Insert Table 6 here

3.5 Tests for Model Statistical Robustness

3.5.1 'Hit and Miss' Test

A test of 'goodness of fit' is the hit and miss test which is described by Greene (2006):

'a useful summary of the predictive ability of the model is a 2x2 table of the hits and misses of a prediction rule such as:

$$y = 1 \text{ if } \mathbb{F} > F^* \text{ and } 0 \text{ otherwise}\ldots\text{' (Greene, 2006).}$$

Thus, the model's prediction of the number of '0' and '1' outcomes is compared with what occurred in the data-set. To do this, a threshold value must be chosen for a probability (this probability is calculated with the model) which,

if exceeded yields one, otherwise, zero. There are as many of these calculated probabilities as there are individual observations in the data-set.

A naïve predictor, or threshold, would be 0.5, however Greene (2006) pointed out that there is no fixed way to choose the value of this threshold. He also pointed out that the actual distribution of positive outcome will influence the acceptable value of the threshold; he asserted that the suitable value would be dependent on circumstances. With this in mind, we took the proportion of HIV positive individuals in the sample as the threshold in the first instance.

The log-likelihood ratio was quite low. The Wald test is often used as a *de facto* log likelihood ratio test. It was not significant at 5% yet was at 10%. For the hit and miss test the threshold chosen needs to be appropriate to the situation, however the method by which that threshold is chosen was, as ever, opaque. In order to do so we described a variable (pfit) which predicted the probability of HIV outcomes from the model which itself was estimated to maximise the likelihood of an HIV positive outcome. These results are also shown in Figure 1, demonstrating the distribution of pfit's values.

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Insert Table 7 here

Insert Figure 1 here

Insert Table 8 here

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By this standard, the model was doing quite well in an important respect. It predicted 82.5% of HIV positive outcomes. However it over-predicted HIV negative outcomes at 107.3%. In 'hit and miss' tests, one type of error is traded off against the other type (i. e.: incorrectly classifying 0's as 1's and 1's as 0's).

3.6 Data Limitations

In presenting the results of this study as we have done above, we have to recognize that the data set is small. This will compound errors that crept in from the untruthful answering of questions by the prisoners interviewed. The likelihood of the models was not able to rise too far beyond -150. This was perhaps due in large part to the fact that the study attempted to maximize a positive HIV outcome, and the prevalence of HIV positive individuals in the sample fell just short of 30%. In this vein, descriptive statistics may better serve our purposes in some cases, although the data has shown itself, with patience, to be capable of bearing up under traditional econometric techniques.

4. Discussion

The limitations of the data presented here direct us toward our first point for discussion, namely that in terms of the clinical management of HIV/AIDS for South Africa's incarcerated population, more studies mapping sero-prevalence rates to socio-economic variables ought to be conducted. The scope for research of this kind will be inherently limited due to the voluntary nature of the studies, nevertheless in a situation where finite resources are being expended to reach targets where [i] comprehensive HIV and AIDS programmes and services are implemented in a mere 50% of 'management areas' and [ii] only 45 per cent of prisoners participated in educational programmes in 2008/09 (see above, Table 1) further data that throws the results of the present study into relief – either by confirming or refuting the results achieved here – provides the policy option of targeting these services such that they are more efficiently and effectively delivered based upon a justifiable discrimination of resource allocation. It would also witness policy conform to the third key priority area of the *National Strategic Plan 2007-11*, namely that of 'research, monitoring and surveillance' of the epidemic (Department of Health, 2007).

While sero-prevalence studies focussing on correlations with socio-economic variables are a source of rich data, achieving more accurate basic epidemiological data ought also to be reflected in the management of the epidemic inside the DCS and the Judicial Inspectorate of Prisons in particular. Nowhere more so is this the case than in dispensing with the three-way categorisation of deaths in custody – 'natural' and 'unnatural' deaths and 'medical release' – by introducing a discrete category for prisoners who die or are discharged due to AIDS-related illnesses. This uncomplicated step – based as it is upon a clinician's assessment – would not only provide important aggregate data but would facilitate better targeting of resources and conform to the requirement of monitoring and surveillance as well as research under the third key priority area of the *National Strategic Plan 2007-11*.

A study of the kind undertaken here naturally directs our attention toward the incarcerated population and the relationship between specific cohorts with respect to HIV/AIDS. For example, aside from the strong correlations between ethnicity and age and HIV/AIDS prevalence rates, men who had been in prison for a longer time had a significantly lower chance of being HIV infected, with the analysis indicating a 29 per cent reduction in HIV

prevalence for every one year increase in length of time in prison (see Table 4 above). Similarly, the fact that the prevalence of HIV was lowest in individuals with no education may merely reflect those individuals unwillingness to participate in a study such as the one undertaken. However, detail of this kind ought not to distract us from the complex relationship between the incarcerated populations on the one hand and those communities which interface with the 30,000 prisoners released each month on the other. It is with this latter cohort that further research can also be directed.

5. Conclusions

This paper reported results of HIV prevalence of an African prison population. It also reported on the socio-economic influences which determined the HIV positive status of prisoners in a South African prison. The level of HIV infection in black prisoners was 250% higher than the community norm in South Africa. The three other ethnic groups were represented by very small numbers in this particular study, thereby provoking caution before any discussion about this study's representativeness of their situation. Nevertheless, the primary socio-economic characteristic which determined HIV status was ethnicity. Age was the secondary determinant of being HIV positive. Income exerted a small but statistically significant influence on HIV status. Marital status, education level, and other variables had no influence on prisoners' HIV status.

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Table 1. DCS, 2008/9: Strategy, targets and performance for HIV/AIDS Program

Strategy	Target	Actual
D.1.4. Provision of comprehensive HIV and AIDS programmes and services to all offenders	Offenders in 20% of management areas are profiled in relation to HIV & AIDS;	Pilot data captured and analysed in the identified Management Areas.
	Implementation of comprehensive HIV and AIDS programmes and services in 50% of all Management Areas	Comprehensive HIV and AIDS programmes and services implemented in 50% of the Management Areas.
	% of offenders participating in HIV/AIDS sessions (More than 19 500 sessions)	72, 746 offenders participated

Source: Adapted from DCS *Annual Report 2008/09*

Table 2. Demographic Characteristics of Inmates

	HIV Negative	HIV Positive	Mean All
Age	Years		
Mean	31.7	28.7	30.6
	Percentage		
Ethnicity			
Indian	6	1	5
Black	89	96	91
Coloured	3	3	3
White	2	0	1
Education			
No schooling	47	18	46
Years 1-9	49	49	49
Years 10-11	3	33	4
Post-education			
Not achieved	90	93	91
Technical	4	3	3
University	3	0	2
Technical certificate	2	3	2
Secretarial certificate	0	1	0
Others	2	1	1
Marital status			
Single, never married	60	59	60
Married	19	23	20
Divorced	11	4	9
Living with de facto	4	1	3
Widowed	7	14	8

Table 3. Prisoner HIV Status by Ethnicity

Ethnicity	HIV Negative	HIV Positive	Total
Indian	11	1	12
Black	170	77	247
Coloured	6	2	8
White	4	0	4
Total	191	80	271

Table 4. Positive HIV Prisoner Status by Age

Age	Number and prevalence ratio	(%)
< 25	20/47	43
25-29	31/100	31
30-34	15/56	27
35-40	10/33	30
> 40	4/35	11

Table 5. Probit Model Estimates

Variable	Coefficient	S.E.	z	P>|z|	95% C.I.
Constant	-6.851	0.521	-13.14	0.000*	-7.873 – -5.929
Ethnicity - Indian	5.104	0.724	6.73	0.000*	3.876 – 6.025
Ethnicity - Black	5.834	0.485	12.01	0.000*	4.882 – 6.786
Ethnicity - Coloured	5.597	0.658	8.51	0.000*	4.308 – 6.887
Age 18-22	0.084	0.369	2.30	0.022*	0.123 – 1.570
Age 23-32	0.600	0.278	2.15	0.031*	0.053 – 1.146
Age 33-39	0.571	0.298	1.91	0.056	-0.013 – 1.156
Education (Post Secondary)	-0.175	0.217	-0.08	0.936	-0.443 – 0.408
Income	-0.000	0.002	2.68	0.007*	-0.000 – 0.000

Notes: 1. Log likelihood = -156.3029

2. Log-likelihood ratio $(1 - L/L_0) = 0.04941341$

3. Likelihood ratio test of income = 0: $chi2(1) = 2.95$ $Prob > chi2 = 0.0860$

4. * - significant at 5%

Table 6. Income Level Prior to Incarceration

	HIV Negative	HIV Positive	Average All
	(%)		
Income (Rand/Month)			
< 5,000	76	83	78
5,001-15,000	14	9	12
15,001-25,000	4	4	4
25,001-35,000	2	1	1
35,001-45,000	2	1	1
> 45,000	3	3	3
	Rand		
Mean Income (Rand/Month)	6225	5438	5995
Standard Deviation			14666
	(%)		
Sources of Income			
Formal employment	16	14	15
Informal employment	29	28	29
Gifts	3	1	2
Drugs	15	1	11
Other illegal sources	38	56	43

Note: At the time of writing, the South African Rand was 7.70 to one United States dollar.

Table 7. Goodness of Fit

Mean	0.296
Standard Error	0.006
Standard Deviation	0.103
Skewness	-0.309
Kurtosis	8.862

Table 8. Model Predicted Prisoner HIV Status

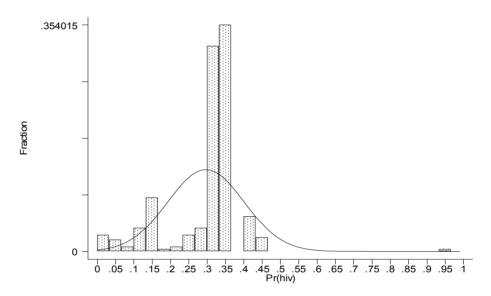|	HIV Negative	HIV Positive	Total
Predicted	205	66	271
Actual	191	80	271

Figure 1. Distribution of Probabilities of HIV Positive Status

In the event, the test was conducted with 0.296 employed as the threshold value.