



## ORIGINAL ARTICLE

# HIV risk behaviour among public primary healthcare patients with tuberculosis in South Africa

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**Objective.** To identify factors associated with HIV in tuberculosis (TB) patients in a public primary healthcare (PHC) setting in South Africa (SA).

**Method.** Among 4 900 consecutively selected TB patients (54.5% men; women 45.5%) from 42 public PHC clinics in 3 districts in SA, a cross-sectional survey was performed to assess new TB and new TB retreatment patients within one month of anti-TB treatment.

**Results.** The sample comprised 76.6% new TB patients and 23.4% TB retreatment patients. Of those who had tested for HIV, 59.9% were HIV-positive; 9.6% had never tested for HIV. In multivariate analysis, older age (odds ratio (OR) 5.86; confidence interval (CI) 4.07 - 8.44), female gender (OR 0.47; CI 0.37 - 0.59), residing in an informal settlement (OR 1.55; CI 1.13 - 2.12), being a TB retreatment patient (OR 0.55; CI 0.42 - 0.72), occasions of sexual intercourse with condom use (OR 1.07; CI 1.02 - 1.13) and having a sexual partner receiving antiretroviral treatment (ART) (OR 7.09, CI 4.35 - 11.57) were associated with an HIV-positive status in TB patients.

**Conclusion.** This study revealed high HIV risk behaviour (e.g. unprotected last sexual intercourse and alcohol and drug use in the context of sexual intercourse) among TB patients in SA. Various factors were associated with HIV risk behaviour. Condom use and substance use risk reduction need to be considered as HIV-prevention measures when planning such strategies for TB patients.

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South Africa (SA) has 0.7% of the world's population and 28% of the world's population of HIV/tuberculosis (TB) co-infected individuals.<sup>[1]</sup>

It has been estimated that approximately 60% of people with TB are co-infected with HIV.<sup>[1]</sup> Co-infected patients have almost double the chance of acquiring multidrug- (MDR-TB) and extensively drug-resistant TB (XDR-TB), and have a high mortality rate.<sup>[2]</sup>

Several studies have found a high level of HIV risk behaviour (e.g. multiple sexual partners, lack of condom use, intravenous drug use) among TB/HIV co-infected patients receiving anti-TB treatment.<sup>[3-6]</sup> Factors associated with HIV status in TB patients have included female gender, age 26 - 35 years, unmarried marital status, a higher income, belonging to a specific population group and engaging in high-risk practices.<sup>[3,4,7]</sup>

The aim of this study was to identify factors associated with HIV in TB patients in public primary healthcare (PHC) in SA.

## Methods

A cross-sectional survey was conducted among TB patients in public PHC clinics in SA, in the three provinces with the highest TB caseload. One district with the highest TB caseload per province ( $N=3$ ) was ultimately included in the study: Siyanda in the Northern Cape, Nelson Mandela Metropole in the Eastern Cape, and eThekweni in KwaZulu-Natal. Within each district, 14 PHC facilities (PHC clinics or community health centres)

were selected ( $N=42$ ) on the basis of the highest TB caseload per clinic. Healthcare providers identified all new TB treatment and retreatment patients aged  $\geq 18$  years, informed them about the study and referred them for participation, if interested. Recruited patients were consecutively interviewed within one month of anti-TB treatment. Interviews were conducted by trained external research assistants over a period of 6 months in 2011 in all 42 clinics. The research assistants asked for permission/consent from the recruited patients to participate in the interview. Ethical approval was granted by the Research Ethics Committee of the Human Sciences Research Council (protocol REC 1/16/02/11) and by the National Department of Health.

## Measures

### Socioeconomic characteristics

A researcher-designed questionnaire was used to record information on participant age, gender, educational level, marital status, income, employment status, dwelling characteristics and residential status. Poverty was assessed with 5 items on the availability or non-availability of shelter, fuel or electricity, clean water, food and cash income in the past week. Response options ranged from 1 = 'not one day' to 4 = 'every day of the week'. Poverty was defined as having a higher score on non-availability of essential items. The total score ranged from 5 to 20; 5 = low, 6 - 12 = medium and 13 - 20 = high poverty. Cronbach's  $\alpha$  for the poverty index was 0.89 in this sample.

**Table 1. Socioeconomic characteristics of the sample**

Characteristic	Total (N=4 900)	Men (n=2 671; 54.5%)	Women (n=2 229; 45.5%)	$\chi^2$ or t	p-value
Age (years) (range 18 - 93), mean ( $\pm$ SD)	36.2 ( $\pm$ 11.5)	37.2 ( $\pm$ 11.5)	34.8 ( $\pm$ 11.4)	7.29	0.000
Age group (years), n (%)				75.43	0.000
18 - 24	643 (13.3)	276 (10.6)	358 (16.5)		
25 - 34	1 841 (38.1)	928 (35.7)	899 (41.4)		
35 - 44	1 313 (27.1)	780 (30.0)	515 (23.7)		
45 - 54	671 (13.9)	399 (15.3)	259 (11.9)		
55 - 64	265 (5.5)	161 (6.2)	95 (4.4)		
$\geq$ 65	104 (2.2)	58 (2.2)	45 (2.1)		
Population group, n (%)					
Black	4 078 (84.6)	2 175 (83.9)	1 845 (85.3)	1.66	0.198
Coloured	634 (13.1)	345 (13.3)	281 (13.0)	0.11	0.742
Indian/Asian/white/other	114 (2.3)	71 (2.7)	37 (1.7)	5.63	0.018
Marital status					
Never married	3 323 (72.7)	1 734 (70.2)	1 589 (75.6)	16.68	0.000
Married/co-habiting	982 (21.5)	594 (24.1)	388 (18.5)	21.03	0.000
Separated/divorced/widowed	265 (5.8)	141 (5.7)	124 (5.9)	0.08	0.783
Education, n (%)					
$\leq$ Grade 7	1 269 (26.3)	745 (28.8)	502 (23.2)	19.49	0.000
Grade 8 - 11	2 213 (45.9)	1 126 (47.4)	960 (44.3)	4.63	0.031
$\geq$ Grade 12	1 336 (27.7)	613 (23.7)	704 (32.5)	45.32	0.000
Poverty index (5 - 20), n (%)				2.22	0.329
Low (5)	1 592 (35.0)	882 (35.2)	710 (34.4)		
Medium (6 - 12)	2 195 (48.2)	1 117 (47.2)	1 018 (49.3)		
High (13 - 20)	768 (16.9)	433 (17.4)	335 (16.2)		
Geolocality, n (%)					
Urban residence	3 151 (66.2)	1 691 (65.4)	1 460 (67.2)	1.56	0.212
Rural residence	877 (18.4)	480 (18.6)	397 (18.3)	0.08	0.780
Informal settlement	730 (15.3)	413 (16.0)	317 (14.6)	1.79	0.181

### Psychological distress

The Kessler psychological distress scale (K-10) was used to measure global psychological distress, including significant pathology that did not meet the formal criteria for a psychiatric illness.<sup>[8,9]</sup> The following symptoms were assessed by asking: 'In the past 30 days, how often did you feel: nervous; so nervous that nothing could calm you down; hopeless; restless or fidgety; so restless that you could not sit still; depressed; that everything was an effort; so sad that nothing could cheer you up; worthless; tired out for no good reason?' The frequency with which each of item was experienced was recorded using a five-point Likert scale ranging from 0 = 'none of the time' to 5 = 'all the time'. This score was summed, with increasing scores reflecting an increasing degree of psychological distress. This scale serves to identify individuals who are likely to meet formal definitions of anxiety and/or depressive disorders, as well as to identify individuals with sub-clinical illness who may not meet formal definitions for a specific disorder.<sup>[8]</sup> The scale has been validated in HIV-positive individuals in SA.<sup>[10]</sup> There was significant agreement between the K-10 and the MINI-defined depressive and anxiety disorders. A receiver operating characteristic (ROC) curve analysis indicated that the K-10 showed agreeable sensitivity and specificity in detecting depression (area under the ROC

curve (AUC) 0.77), generalised anxiety disorder (AUC 0.78) and post-traumatic stress disorder (AUC 0.77).<sup>[10]</sup> The K-10 scale was used as a binary variable comparing scores  $\geq$ 30 or  $<$ 30. The internal reliability coefficient for the K-10 was  $\alpha=0.92$ .

### Alcohol consumption

The 10-item alcohol use disorders identification test (AUDIT)<sup>[11]</sup> assesses alcohol consumption level (3 items), symptoms of alcohol dependence (3 items) and problems associated with alcohol use (4 items). Heavy episodic drinking is defined as the consumption of  $\geq$ 6 standard drinks (10 g alcohol) on a single occasion.<sup>[11]</sup> A standard drink in SA is equivalent to 12 g of alcohol. Because the AUDIT is reported to be less sensitive at identifying risk drinking in women, as recommended by Freeborn *et al.*,<sup>[12]</sup> the cut-off point for binge drinking in women (4 units) was reduced by one unit compared with that for men (5 units). Responses to items on the AUDIT are rated on a 4-point Likert scale from 0 to 4 (maximum score 40 points). A higher AUDIT score indicates a more severe level of risk: a score  $\geq$ 8 indicates a tendency to problematic drinking. The AUDIT has been validated in HIV-positive patients in SA, showing excellent sensitivity and specificity in detecting MINI-defined dependence/abuse (AUC 0.96),<sup>[13]</sup> and among TB and

**Table 2. Health and HIV risk characteristics**

Characteristic	Total (N=4 900)	Men (n=2 671)	Women (n=2 229)	$\chi^2$ or t	p-value
TB status, n (%)					
New TB treatment patient	3 650 (76.6)	1 946 (75.2)	1 704 (78.4)		
TB retreatment patient	1 113 (23.4)	643 (24.8)	470 (21.6)	6.83	0.009
HIV status, n (%)					
HIV-positive	2 585 (59.9)	1 222 (53.4)	1 363 (67.4)		
HIV-negative	1 728 (40.1)	1 068 (46.6)	660 (32.6)	87.83	0.000
Never tested for HIV, n (%)	449 (9.6)	311 (12.3)	138 (6.5)	43.69	0.000
Perceived health status, n (%)					
Excellent/very good	912 (19.1)	524 (20.2)	388 (17.8)		
Good	1 646 (34.6)	874 (33.8)	772 (35.5)		
Fair/poor	2 205 (46.3)	1 190 (46.0)	1 015 (46.7)	4.72	0.095
Severe psychological distress (based on Kessler 10), n (%)	1 183 (26.3)	660 (26.9)	523 (25.6)	0.90	0.341
HIV risk behaviour					
Sexually active in the past 3 months, n (%)	2 318 (51.3)	1 336 (54.1)	982 (48.0)	16.63	0.000
Last sexual intercourse unprotected, n (%)	2 319 (54.9)	1 243 (54.0)	1 076 (56.0)	1.67	0.196
Sexual intercourse with condom use (occasions), mean ( $\pm$ SD)	1.72 ( $\pm$ 0.8)	1.69 ( $\pm$ 0.8)	1.77 ( $\pm$ 0.8)	-2.66	0.008
Sexual intercourse without condom use (occasions), mean ( $\pm$ SD)	1.53 ( $\pm$ 0.7)	1.55 ( $\pm$ 0.7)	1.49 ( $\pm$ 0.7)	2.05	0.040
Alcohol, drug and tobacco use, n (%)					
AUDIT				234.10	0.000
Low (0 - 7)	3 637 (76.8)	1 759 (68.2)	1 878 (87.0)		
Medium (8 - 19)	785 (16.6)	579 (22.5)	206 (9.5)		
High (20 - 40)	315 (6.6)	241 (9.3)	74 (3.4)		
Alcohol before sexual intercourse	537 (20.9)	376 (25.6)	161 (14.7)	43.67	0.000
Drugs before sexual intercourse	237 (9.3)	148 (10.1)	89 (8.2)	2.75	0.098
Current tobacco use	1 290 (27.6)	1 006 (39.6)	284 (13.3)	399.29	0.000
Sexual partner, n (%)					
Disclosed HIV status to partner	2 729 (63.9)	1 479 (63.5)	1 250 (63.6)	0.01	0.923
Partner HIV-positive v. HIV-negative or unknown	1 192 (27.2)	600 (25.0)	592 (29.8)	12.70	0.000
Sexual partner receiving ART	434 (11.1)	244 (11.5)	190 (10.7)	0.75	0.387

TB = tuberculosis; AUDIT = alcohol use disorders identification test; SD = standard deviation; ART = antiretroviral therapy; OR = odds ratio; CI = confidence interval.

HIV patients in PHC in Zambia, demonstrating good discriminatory ability in detecting MINI-defined current alcohol use disorders (AUDIT 0.98 for women and 0.75 for men).<sup>[14]</sup> Cronbach's  $\alpha$  for the AUDIT in this sample was 0.92, indicating excellent reliability.

### Tobacco use

Two questions were asked about the use of tobacco products: (i) 'Do you currently use one or more of the following tobacco products (cigarettes, snuff, chewing tobacco, cigars, etc.)?' (response options were 'yes' and 'no'); and (ii) 'In the past month, how often have you used one or more of the following tobacco products (cigarettes, snuff, chewing tobacco, cigars, etc.)?' (response options were: 'once or twice', 'weekly', 'almost daily' and 'daily'). Current tobacco use was defined as having used any tobacco product in the past month.

### Perceived general health

Participants were asked: 'In general, would you say your health is: excellent, very good, good, fair or poor?' This measure was categorised

based on participant response (very good = excellent/very good; good; and poor = fair/poor).

TB treatment, HIV and antiretroviral therapy (ART) status were assessed by self-report and from medical information. HIV risk behaviour was assessed in terms of the following: whether or not the participant was sexually active in the past 3 months; whether or not the last occasion of sexual intercourse was unprotected; the number of occasions of sexual intercourse with condom use in the past 3 months; the number of occasions of sexual intercourse without condom use in the past 3 months; alcohol use before sexual intercourse in the past 3 months; illegal drug use before sexual intercourse in the past 3 months; whether or not the participant had disclosed his/her HIV status to the sexual partner; the HIV status of the sexual partner; and the ART status of the sexual partner.

### Data analysis

Data were analysed using SPSS software (version 19.0). Frequencies, means and standard deviations (SDs) were calculated to describe the

sample. Data were checked for normality distribution and outliers. For non-normal distribution, non-parametric tests were used. Associations of HIV status were identified using logistic regression analyses. Following each univariate regression, multivariate regression models were constructed. Independent variables from the univariate analyses were entered into the multivariate model if significant at  $p < 0.05$ . For each model, the  $R^2$  values were calculated to describe the amount of variance explained by the multivariate model. A  $p$ -value  $< 0.05$  was regarded as statistically significant.

## Results

From the sample ( $N=4\ 935$ ) approached for inclusion in the study, 35 (0.7%) patients declined the request to participate. The final sample included 4 900 patients (54.5% men; 45.5% women) of mean age 36.2 years ( $SD \pm 11.5$ ; range 18 - 93). Almost two-thirds (65.2%) were aged 25 - 44 years, most (72.7%) were never married, 27.7% had completed secondary education, 17% scored high on the poverty index, 24.2% had a formal salary as a main household income, and 58.9% were unemployed. A significant number of participants (15.3%) lived in informal settlements (Table 1).

### Health and HIV risk characteristics

Of the total sample, 76.6% were new TB patients and 23.4% were TB retreatment patients. Of those who had tested for HIV, 59.9% were HIV-positive; 9.6% had never tested for HIV. More than 1/4 patients (27.6%) were current (past month) tobacco users, 26.3% had severe psychological distress, and 46.3% perceived their health status as fair or poor. Regarding sexual risk behaviour, 54.9% had had unprotected sexual intercourse on the last occasion thereof, and 20.9% had used alcohol and 9.3% illegal drugs before sexual intercourse in the past 3 months. Two-thirds (63.9%) of the participants had disclosed their HIV status, 27.2% had a sexual partner who was HIV-positive and 11.1% had a sexual partner who was receiving ART (Table 2).

### HIV status, socioeconomic factors, health status and HIV risk behaviour

In univariate analysis, the following were associated with an HIV-positive status among TB patients: older age; female gender; not being poor; black race; residing in an informal settlement; being a TB retreatment patient; poor perceived health status; not currently using tobacco products; not being sexually active in the past 3 months; having unprotected sexual intercourse on the last occasion thereof; the number of occasions of sexual intercourse with condom use; hazardous or harmful alcohol use; alcohol use before sexual intercourse in the past 3 months; drug use before sexual intercourse in the past 3 months; and having a sexual partner who was receiving ART. In multivariate analysis, the following were associated with an HIV-positive status in TB patients (Table 3): older age; female gender; residing in an informal settlement; a TB retreatment status; number of occasions of sexual intercourse with condom use; and having a sexual partner who was receiving ART.

## Discussion

This study revealed a high prevalence (59.9%) of co-infection with HIV among a large sample of TB patients in public PHC in SA, similar to the findings of other studies (60%).<sup>[1]</sup> Further, there was a high level of HIV risk behaviour (last occasion of sexual intercourse unprotected, and alcohol and drug use in the context of sexual intercourse), in agreement

with other studies.<sup>[3-6]</sup> This is alarming, given the high rate of HIV/TB co-infection at a national level in SA.<sup>[1]</sup> The dual epidemics of HIV and TB have become a public health priority, and this is beginning to receive increasing attention from the National Department of Health as specified in the National Strategic Plan 2012 - 2016.<sup>[15]</sup> TB cannot, therefore, be managed as a single disease entity. A comprehensive treatment and prevention programme for TB, HIV and indeed other co-morbid disorders is required to meet this public health challenge. In the context of this study, condom use and substance use risk reduction need to be considered as HIV-prevention measures when planning HIV-prevention programmes for TB patients.

In multivariate analysis, older age, female gender, residing in an informal settlement, being a TB retreatment patient, occasions of sexual intercourse with condom use, and having a sexual partner receiving ART were associated with HIV-positive status in TB patients. In agreement with other studies,<sup>[3]</sup> sociodemographic variables (female gender and older age) were associated with HIV status in TB patients. In contrast, unlike in other studies,<sup>[3,4,7]</sup> marital status, income, population group and engaging in high-risk practices were not associated with an HIV-positive status. Furthermore, TB retreatment patients were more likely to be HIV-positive than new TB treatment patients. These data provide information to inform HIV-prevention strategies.

### Study limitations

Caution should be taken when interpreting the results of this study because of certain limitations. As this was a cross-sectional study, causality between the compared variables cannot be concluded. A further limitation was that most variables were assessed by self-report and desirable responses may have been given. The population surveyed originated predominantly from urban areas, and may not be representative of other settings in SA.

## Conclusion

This study revealed a high HIV risk behaviour among TB patients in SA. Various factors were identified associated with this behaviour, providing information for HIV-prevention strategies. Condom use and substance use risk reduction need to be considered as HIV-prevention measures when planning HIV-prevention programmes for TB patients.

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**Table 3. Association between HIV status, socioeconomic factors, health status and HIV risk behaviour**

Socio-economic factor	Crude OR (95% CI) <sup>a</sup>	Adjusted OR (95% CI) <sup>b</sup>
Age group (years)		
18 - 24	1.00	1.00
24 - 34	3.26 (2.68 - 3.96) <sup>‡</sup>	3.19 (2.29 - 4.43) <sup>‡</sup>
35 - 44	4.01 (3.25 - 4.94) <sup>‡</sup>	5.86 (4.07 - 8.44) <sup>‡</sup>
≥45	1.58 (1.27 - 1.95) <sup>‡</sup>	2.37 (1.60 - 3.49) <sup>‡</sup>
Male v. female	0.55 (0.49 - 0.63) <sup>‡</sup>	0.47 (0.37 - 0.59) <sup>‡</sup>
Marital status		
Never married	1.00	-
Married/co-habiting	0.88 (0.76 - 1.02)	-
Separated/divorced/widowed	0.71 (0.55 - 0.93)	-
Education		
≤Grade 7	1.00	-
Grade 8 - 11	1.14 (0.98 - 1.32)	-
≥Grade 12	1.04 (0.88 - 1.23)	-
Poverty index		
Low	1.00	1.00
Medium	1.12 (0.88 - 1.17)	0.90 (0.70 - 1.14)
High	0.45 (0.37 - 0.54) <sup>‡</sup>	0.77 (0.55 - 1.09)
Population group		
Black	1.00	1.00
Coloured	0.21 (0.17 - 0.26) <sup>‡</sup>	0.29 (0.20 - 0.41)
Indian/Asian/white/other	0.26 (0.17 - 0.39) <sup>‡</sup>	0.26 (0.12 - 0.58)
Geolocality		
Urban residence	1.00	1.00
Rural residence	0.95 (0.82 - 1.12)	0.82 (0.61 - 1.10)
Informal settlement	1.43 (1.19 - 1.71) <sup>‡</sup>	1.55 (1.13 - 2.12) <sup>*</sup>
New TB treatment v. retreatment patient	0.72 (0.62 - 0.83) <sup>‡</sup>	0.55 (0.42 - 0.72) <sup>‡</sup>
Perceived health status		
Excellent/very good	1.00	1.00
Good	2.33 (1.95 - 2.77) <sup>‡</sup>	2.51 (1.89 - 3.34)
Fair/poor	4.34 (3.66 - 5.16) <sup>‡</sup>	4.83 (3.61 - 6.46)
Severe psychological distress	1.02 (0.89 - 1.18)	-
HIV risk behaviour		
Sexually active in the past 3 month	0.83 (0.73 - 0.94) <sup>†</sup>	1.06 (0.70 - 1.59)
Last sexual intercourse unprotected	1.26 (1.11 - 1.44) <sup>‡</sup>	1.56 (1.23 - 1.99)
Occasions of sexual intercourse with condom use	1.09 (1.06 - 1.13) <sup>‡</sup>	1.07 (1.02 - 1.13) <sup>*</sup>
Occasions of sexual intercourse without condom use	1.01 (0.97 - 1.05)	-
Alcohol, drug and tobacco use		
AUDIT		
Low	1.00	1.00
Medium	0.85 (0.72 - 1.00) <sup>*</sup>	1.01 (0.75 - 1.37)
High	0.74 (0.58 - 0.94) <sup>*</sup>	0.96 (0.62 - 1.48)
Alcohol before sexual intercourse	1.09 (1.02 - 1.17) <sup>*</sup>	0.92 (0.81 - 1.04)
Drugs before sexual intercourse	1.22 (1.13 - 1.32) <sup>‡</sup>	1.08 (0.93 - 1.25)
Current tobacco use	0.60 (0.52 - 0.68) <sup>‡</sup>	0.98 (0.76 - 1.27)
Sexual partner		
Disclosed HIV status to sexual partner	0.99 (0.86 - 1.14)	-
Sexual partner receiving ART	4.09 (3.09 - 5.41) <sup>‡</sup>	7.09 (4.35 - 11.57) <sup>‡</sup>

TB = tuberculosis; AUDIT = alcohol use disorders identification test; SD = standard deviation; ART = antiretroviral therapy.

<sup>a</sup> Using 'enter' LR selection of variables; <sup>b</sup> Hosmer and Lemeshow chi-square 15.41, df 8, 0.052; Cox and Snell R<sup>2</sup> 0.25; Nagelkerke R<sup>2</sup> 0.34.

<sup>\*</sup>p<0.05; <sup>†</sup>p<0.01; <sup>‡</sup>p<0.001.

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