

# The prevalence of HIV in Pretoria's Medico-Legal Laboratory cases, RSA, in 2009

N Morris<sup>1</sup>, L du Toit-Prinsloo<sup>1</sup>, L Webber<sup>2</sup>, G Saayman<sup>1</sup>

<sup>1</sup> Department of Forensic Medicine, University of Pretoria, South Africa

<sup>2</sup> Department of Medical Virology, University of Pretoria, South Africa

*Correspondence:* Mr Neil Morris, Department of Forensic Medicine, University of Pretoria, PO Box 2034, Pretoria, South Africa, 0001. e-mail: neil.morris@up.ac.za

## ABSTRACT

The purpose of this study was to determine the prevalence of Human Immunodeficiency Virus (HIV) amongst decedents admitted to the Pretoria Medico-Legal Laboratory (MLL). The study was designed as a cross sectional study. It is not standard procedure for the pathologist to do a HIV test at autopsy. Post mortem (PM) blood samples were obtained from all bodies admitted to the Pretoria MLL during one month in 2009. Analysis of the blood samples was performed using standardised laboratory procedures. Two hundred and thirty-eight PM blood samples were collected. In 43 cases (17%), the test results were invalid. Of the 195 valid test samples, 51 (26.2%) were HIV-positive. The prevalence of HIV in this study was 15% higher than that reported in a similar study done 10 years previously.

**Keywords:** post mortem, HIV prevalence, medico legal laboratory, occupational health and safety, autopsy

## INTRODUCTION

Infection with Human Immunodeficiency Virus (HIV) has risen to the status of a global pandemic. According to the World Health Organization (WHO), in 2008, 33.4 million people were living with the disease globally and there were two million deaths due to HIV.<sup>1</sup> The WHO report documents the global scale of HIV and the influence that the pandemic has on specific continental regions. Sub-Saharan Africa carries the largest burden of the disease with 22.4 million

people living with HIV and 1.4 million deaths associated with the disease in 2008.<sup>1</sup>

South Africa had a population of 49.3 million in mid-2009 with a stated HIV prevalence of 17.0% in the 15-49 year-old age group and 10.6% in the entire population.<sup>2</sup> According to the 2008 WHO report on the global AIDS epidemic there were 5.7 million adults and children living with HIV in South Africa and 350 000 HIV-related deaths in 2007.<sup>3</sup> South Africa is at the forefront of the pandemic and should be taking a leading role in the battle against HIV. Based on these very high numbers, it is clear that thorough and ongoing research is required pertaining to the incidence and impact of HIV in our society.

Pretoria is the capital city of South Africa with an estimated population of 1.338 million people in 2008.<sup>4</sup> The Pretoria Medico-Legal Laboratory (MLL) serves the greater Pretoria region and is responsible for admission of external causes of death cases for medico-legal investigation. Approximately 2 500 cases are admitted per year, accounting for 10.5% of all deaths in the greater Pretoria area.<sup>5</sup>

There are very little data available regarding the prevalence of HIV amongst deceased individuals undergoing medico-legal autopsy in South Africa. A thorough literature review revealed only one study that has addressed this issue, conducted by du Plessis et al. in 1999.<sup>6</sup> They tested a total of 265 peripheral blood samples and calculated the prevalence of HIV in the Pretoria MLL as 11% overall

**Table 1. Total cases analysed and validity of the samples in the Pretoria MLL**

Result of HIV test	Bodies		Blood samples collected		Valid blood samples	
	n	%	n	%	n	%
Invalid	43	16.7	43	18.1	-	-
Negative	144	56.0	144	60.5	144	73.8
Positive	51	19.8	51	21.4	51	26.2
No Sample	19	7.4	-	-	-	-
<b>Total</b>	<b>257</b>		<b>238</b>		<b>195</b>	

**Table 2. Gender analysis of collected blood samples**

Sex	Bodies		Valid samples		HIV+		HIV-	
	n	%	n	%	n	%	n	%
Female	52	20.2	38	14	36.8	24	63.2	
Male	200	77.8	156	37	23.7	119	76.3	
Undeterminable	5	1.9	1	0		1	100.0	
<b>Total</b>	<b>257</b>		<b>195</b>	<b>51</b>		<b>144</b>		

and 19% in the 15 to 49 year age group.<sup>6</sup> Those results were in accordance with the HIV prevalence estimates at that time.<sup>1-4</sup> Subsequently, there has been little research on the prevalence of HIV in the South African autopsy population.

The objective of this study was to determine the prevalence of HIV amongst decedents admitted to the Pretoria MLL during 2009. With the changing profile of HIV in South Africa, it is imperative to assess the occupational risk of HIV-infection to the forensic pathology staff. Knowledge about the prevalence of HIV in the forensic medical setting will facilitate the adaptation of the occupational health and safety (OHS) protocols implemented in Pretoria MLL in an attempt to minimise the risk of accidental occupational exposure to HIV. The study was designed as a prospective cross sectional study as it is not standard operating procedure for the pathologist to do a HIV test at autopsy.

## METHODS

Post mortem (PM) blood samples were obtained from all bodies admitted to the Pretoria MLL during one month in 2009. The investigation of these deaths is provided for by the Inquests Act 58 of 1959, which prescribes that inter alia a post mortem examination can be conducted. The blood samples were obtained by a medical practitioner following standard procedures at the Pretoria MLL at the time of the autopsy.

Analysis of the blood samples was performed using standardised testing procedures of the National Health Laboratory Service (NHLS), Tshwane Academic Division, Department of Virology. Abbot Determine™ HIV -1/2 rapid qualitative immunoassay (South Africa) test kits were used. Negative results on the Abbot immunoassay were recorded as such with no further investigation. Confirmatory testing was done on a selection (25%) of positive test samples to screen for possible false positive results. The confirmatory test was AxSYM HIV Ag / Ab Combo Micro-particle Enzyme Immunoassay (MEIA) from Abbot AxSYM System, South Africa. The selection of the specific tests for the study was done on the basis of research done by Ly et al. (2004).<sup>7</sup>

The demographic details, case histories and procedure-related information for each case were collected. Confidentiality was ensured by allocating a unique study reference number to each case.

The statistical analysis was done in conjunction with the Department of Statistics at the University of Pretoria. The null hypothesis was that the prevalence of HIV in the Pretoria MLL population would not differ significantly from that of the prevalence of HIV in the general population of Gauteng. Significance was determined at 95%, using chi square analysis. The statistical program SAS® was used for analysis of data. The use of race (black, white, coloured

and Asian) is not scientifically or anthropologically accurate or relevant but serves to inform forensic experts on the traditionally utilised characterisation of social and ethnic groups that, to this day, persist in the South African context, albeit from a historical perspective.

Approval for the study was obtained from the University of Pretoria's Faculty of Health Sciences Research Ethics Committee (clearance certificate no. S104/2009).

## RESULTS

A total of 257 cases were admitted to the Pretoria MLL for investigation during the month. PM blood could not be obtained in 19 (7.4%) of the cases due to factors such as decomposition, skeletonisation and charring (Table 1). In 43 of the 238 cases in which PM samples were collected (18.1%), the test results were invalid. Of the remaining 195 valid test samples, 51 were positive, constituting a HIV prevalence of 26.2% in the study population.

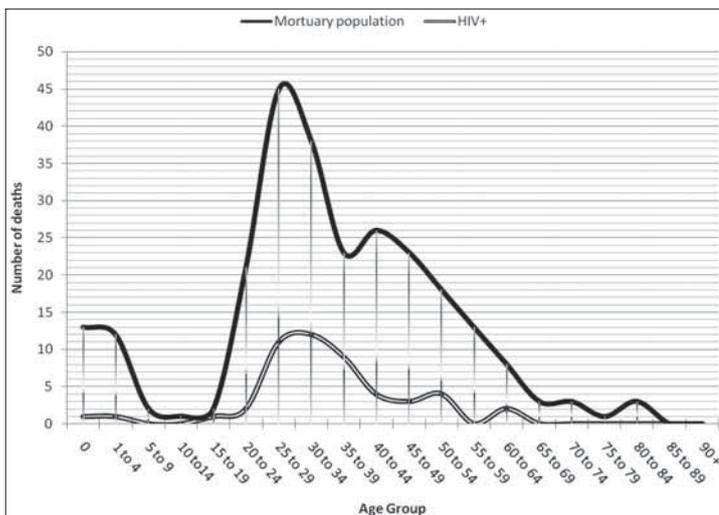
### Demographic characteristics

As shown in Table 2, the majority of decedents were male (77.8%). The prevalence of HIV was higher in females than in males (36.8% and 23.7%, respectively). The racial

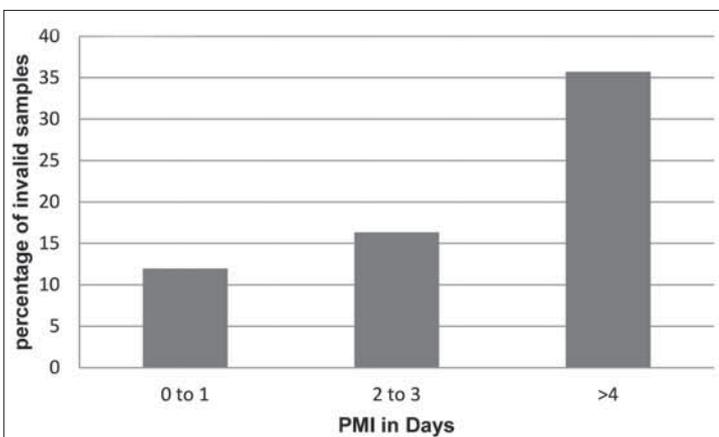
**Table 3. Race analysis of collected blood samples**

Race	Bodies		Valid samples		HIV+		HIV-	
	n	%	n	n	%	n	%	
Asian	3	1.2	3	0		3	100.0	
Black	196	76.3	147	47	32.0	100	68.0	
Coloured	5	1.9	3	0		3	100.0	
White	47	18.3	41	4	9.8	37	90.2	
Undetermined	6	2.3	1	0		1	100.0	
<b>Total</b>	<b>257</b>		<b>195</b>	<b>51</b>		<b>144</b>		

“The current study shows a prevalence of 26.2% HIV sero-positivity in the entire test population and 30.0% sero-positivity in the 15 to 49 year age group”



**Figure 1. Age distribution of HIV-infected cases compared to that of the entire mortuary population**



**Figure 2. Graph of invalid samples (represented as a percentage of the total samples collected) by post mortem interval (PMI) (Chi square test, p= 0.0034)**

distribution is depicted in Table 3. Seventy-six percent of decedents were classified as black, 18.3% as white, 1.9% as coloured and 1.2% as Asian. These percentages were in keeping with provincial population figures at that time.<sup>2</sup> HIV prevalence was 9.8% in the white population and 32.0% in the black population, with no HIV positive cases reported for Asian or coloured decedents.

The age distribution in the study population ranged from younger than 0 (foetuses) to 83 years. Data were grouped into younger than 0 (nonviable products of conception) and then into 5-year age groups, viz. 0-4 years, 5-9 years, 10-14 years, etc. Overall, in the 0-83 year range, the HIV prevalence was 26.2%. The HIV prevalence in the 15 - 49 year age group was 30.0% (Figure 1).

### Invalid test results

The large number of invalid samples (n = 43; 16.7%) warranted further analysis. PM interval (PMI) was determined from incident data and PM information on the National Injury Mortality Surveillance System (NIMSS) data collection forms. The data were then compared to the percentage of invalid test results obtained in specific PMI period categories (0-1 days, 2-3 days and >4 days). The number of invalid HIV test results increased with PMI. By corollary, samples tested closer to the time of death were less likely to be invalid (Figure 2).

### DISCUSSION

This study has important implications for occupational health and safety in the mortuary setting. It has been documented that HIV-2 can be cultured in blood for up to 16 days after death.<sup>8</sup> The invalid results pose an interesting conundrum with regard to the testing procedures of PM samples and the reliability of using such results to make treatment decisions for accidental blood exposure. It is possible that PM haemolysis of blood samples may affect the transportation of samples through the test matrix. Alternatively, the PM interval may allow an inhibiting agent to be produced. In either scenario, the efficacy of the test is reduced, resulting in a large number of invalid test results as the PMI increases. This observation necessitates a review of the treatment guidelines and standard operating procedures related to PM exposure to body fluids. The testing of the samples needs to be expedited and antiretroviral (ARV) treatment needs to be administered even if the test result is invalid.

In 2008, the Pretoria MLL admitted 2 742 decedents for investigation and was the fifth largest MLL in South Africa.<sup>5</sup> An earlier study conducted in 1999 by du Plessis et al., at the same MLL, estimated an 11% prevalence in the Pretoria MLL population which was similar to the prevalence of HIV in the general population at that time.<sup>6</sup> The current study shows a prevalence of 26.2% HIV sero-positivity in the entire test population and 30.0% sero-positivity in the 15 to

49 year age group. In the general Pretoria MLL population, this corresponds to a 15.2% increase over a 10-year period. These figures are in contrast to current HIV prevalence data available for the South African population. The Statistics South Africa 2009 report states that the HIV prevalence for the entire population was 10.6% and increased to 17% in the 15 to 49 year age group.<sup>2</sup> A 2008 WHO study reported 5.7 million cases of HIV in South Africa, which translates to a prevalence of 11.6% in the entire population and 18.1% in the 15 to 49 year age category.<sup>3</sup> The higher HIV prevalence in the current study may be attributed, in part, to the small sample size, the demographics of Pretoria (which are not representative of the general population), or to the possible increased risk-taking behaviour associated with an urban MLL population.

The data suggest that there has been a dramatic increase in HIV prevalence in cases admitted to the Pretoria MLL. Such an increase would suggest that risks of HIV infection for mortuary personnel and those handling deceased individuals (such as emergency care workers, forensic pathology service personnel and funeral undertakers) have increased. This emphasises the importance of people employed in these professions using personnel protective equipment correctly and taking universal precautions. The implementation of OHS compliance and monitoring systems needs to be expedited in high risk environments. This is essential as occupational exposure to HIV becomes more prevalent and the associated risk to the employees increases.

The HIV prevalence in females was 36.8% which is higher than expected.<sup>5</sup> In previously published reports, the HIV prevalence in women was reported as 19.7% by Statistics South Africa in 2009<sup>2</sup> and 13.9% by the Human Science Research Council (HSRC) in the same year.<sup>9</sup> This difference in reported prevalence cannot only be explained by the increased risk-taking behaviour in the female autopsy population alone.<sup>5</sup> The discrepancy raises concerns about the accuracy of the information being disseminated and demonstrates a need for different approaches to collecting and correlating information on HIV in South Africa.

The racial profile for South Africa was as follows in 2009: the black, white, coloured and Asian communities represented 79.3%, 9.1%, 9.0% and 2.6% of the population, respectively.<sup>2</sup> HIV distribution by racial group is not well documented in various reports.<sup>1,2,5</sup> In 2008, the HSRC documented the HIV prevalence in the black and white communities at 13.3% and 0.6%, respectively.<sup>9</sup> The results of the current study show increases across the white and black demographic profiles when compared to findings of du Plessis et al. and other available data published at that time.<sup>1,2,5,6,9</sup> In addition, this study documents the epidemiological change of HIV associated with race in the Pretoria MLL. Therefore, the current research is essential

to documenting the changes in the profile of infection in the Pretoria MLL which could be used to formulate or adapt specific response plans for South African urban settings. This research can be modelled and the risk profile quantified in order to provide a reliable, evidence-based source of HIV prevalence information.

The case profile in the Pretoria MLL is consistent with what is documented in other urban MLLs in South Africa.<sup>5</sup>

### “. . . necessitates a review of the treatment guidelines and standard operating procedures related to PM exposure to body fluids”

Worth mentioning is the fact that there were a number of HIV-infected cases in the cohort that were older than 50 years (n=6; 11.7%). This may reflect a changing profile with regard to age, which could be attributed to the current treatment regime and roll out of ARVs in South Africa. The value of this change is that it is in contrast with the commonly held beliefs of forensic pathology staff in relation to the age group of cases that is infected with HIV. Continued vigilance and implementation of universal precautions in the forensic medical setting is warranted. The beliefs regarding



the demographics (age, race and gender) of HIV infected individuals need to be expressly documented, updated and addressed in the occupational health and safety strategies and training of forensic pathology staff.

## CONCLUSION

The HIV prevalence in Pretoria MLL is, at 26.2%, significantly higher than in the general population. The HIV prevalence in this study was also 15.2% higher than that reported in a similar study done 10 years previously. The occupational risk profile has significantly changed for mortuary personnel and those handling deceased individuals (such as emergency care workers, forensic pathology service personnel and funeral undertakers).

A longer PMI compromises the results of post mortem testing. The longer the PMI, the greater the chances are of obtaining an invalid test result. The testing methods of post mortem blood samples need to be adapted to provide more accurate results and fewer invalid test results.

PM testing of other than natural deaths still holds a wealth of information that can be extracted with minimal invasion of a person's rights and in an appropriate environment, with the necessary safeguards. The data will ultimately play an invaluable role in the monitoring and management of HIV, as well as in formulating new intervention strategies and safe guarding employees who are exposed to the pandemic in the course of their duties.

Personal protective equipment and universal precautions

need to be strictly adhered to and enforced for the safety of all forensic pathology and funeral service industry employees. The implementation of OHS compliance and monitoring systems needs to be expedited in high risk work environments in order to ensure the safety of personnel.

## LESSONS LEARNED

1. Complacency surrounding past observations needs to be guarded against.
2. The assumption that the risk profile for the PM population had not changed has facilitated stagnation in the adaptation of the OHS strategies.
3. Continued training, monitoring and evaluation of the OHS systems and the data on which they were founded will keep at-risk personnel safer.

## CONFLICT OF INTEREST

None of the authors has a conflict of interest.

## FUNDING

Funding was sourced from the National Health Laboratory Service for sample testing. Additional funding was provided for by the University of Pretoria, Department of Forensic Medicine.

## REFERENCES

1. World Health Organization. HIV/AIDS. AIDS epidemic update 2009. Geneva: WHO; 2010 Available at: <http://www.who.int/hiv/pub/epidemiology/epidemic/en/> (Accessed 7 Dec 2010).
2. Statistics South Africa. P0302 - Mid-year population estimates 2009. Available at: <http://www.statssa.gov.za/publications/statsabout.asp?PPN=p0302&SCH=4437> (Accessed 7 Dec 2010).
3. UNAIDS Joint United Nations Programme on HIV/AIDS. 2008 Report on the global AIDS epidemic. Geneva: UNAIDS, 2008. Available at: [http://whqlibdoc.who.int/unhiv/2008/9789291737116\\_eng.pdf](http://whqlibdoc.who.int/unhiv/2008/9789291737116_eng.pdf) (Accessed 11 Mar 2014).
4. UN-HABITAT. The State of the African Cities Report 2008. A framework for addressing urban challenges in Africa. Nairobi: UN-HABITAT; 2008. Available at: <http://www.unhabitat.org/pmss/listItemDetails.aspx?publicationID=2574> (Accessed 11 Mar 2014).
5. Statistics South Africa P0309.3. Mortality and causes of death in South Africa: Findings from death notification 2013. Available at: <http://www.statssa.gov.za/publications/statsabout.asp?PPN=P0309.3&SCH=5490> (Accessed 9 Mar 2014).
6. du Plessis R, Webber L, Saayman G. Bloodborne viruses in forensic medical practice in South Africa. *Am J Forensic Med Pathol.* 1999; 20(4):364-368.
7. Ly TD, Laperche S, Brennan C, Vallari A, Ebel A, Hunt J, et al. Evaluation of the sensitivity and specificity of six HIV combined p24 antigen and antibody assays. *J Virol Methods.* 2004; 122(2):185-194.
8. Douceron H, Deforges L, Gherardi R, Sobel A, Chariot P. Long-lasting postmortem viability of human immunodeficiency virus: a potential risk in forensic medicine practice. *Forensic Sci Int.* 1993; 60(1-2):61-66.
9. Shisana O RT, Simbayi LC, Zuma K, Jooste S, Pillay-van-Wyk V, Mbelle N, Van Zyl J, Parker W, Zungu NP, Pezi S and the SABSSM III Implementation Team. South African national HIV prevalence, incidence, behaviour and communication survey, 2008: a turning tide among teenagers? Cape Town: HSRC Press; 2009. Available at: <http://www.mrc.ac.za/pressreleases/2009/sanat.pdf> (Accessed 30 Nov 2012).
10. World Health Organization. Gender, women and health. Gender and HIV/AIDS. Gender and health information sheet. Geneva: WHO; 2003. Available at: <http://www.who.int/gender/documents/hiv/a85585/en/> (Accessed 30 Nov 2012).