MONITORING HIV-RELATED MORTALITY IN SOUTH AFRICA: THE CHALLENGES AND URGENCY

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Background

It is estimated that 6.4 million persons were living with HIV/AIDS (PLHIVA) in South Africa in 2012, with 370,000–450,000 HIV infections newly acquired.[1] Global data demonstrate that antiretroviral therapy (ART) use has led to decreased morbidity and mortality from HIV-related causes.[2-5] South Africa has mounted a vigorous response to its HIV epidemic by massively scaling up the provision of ART. By the end of 2012, an estimated 2.1 million persons were on ART. This has led to a significant increase in life expectancy in South Africa. In rural South Africa, the expanded ART roll-out has been shown to reduce HIV-related mortality by approximately 22% in men and 29% in women.[6] This reduction occurred in a setting characterised by a very high HIV prevalence and a high mortality attributable to HIV. Furthermore, the success of the prevention of mother-to-child transmission of HIV programme, as witnessed by reductions in vertical HIV transmission rates (from approximately 14% in 2004 to <3% in 2011), has resulted in major decreases in mortality in infants and children under 5 years.[7]

Reliable data that illustrate trends in HIV/AIDS mortality are critical for the measurement and tracking of the impact of ART roll-out and for the implementation of the national strategic plan.[8] In this report, the national reporting system and estimator models of HIV-mortality are critically reviewed, and recommendations to improve the accuracy of the data are given.

Under-reporting of HIV/AIDS-related deaths

Mortality reports released by Statistics South Africa have consistently indicated that 3.4% of deaths in South Africa are HIV/AIDS-related.[9,10] Deeper analysis of these data suggest that this is likely a significant under-estimate because other causes of death known to be associated with HIV/AIDS were also reported. In 2010, other viral diseases, tuberculosis (TB), influenza and pneumonia, and infectious intestinal diseases accounted for 2.3%, 12%, 7.2% and 5% of all deaths respectively. Furthermore, infectious and parasitic diseases were the leading causes of death in 2010 (134,678/543,856 = 24.8%). The rankings of the main infectious disease groups have remained stable since 2008, and it is probable that many of these are indicator diseases for HIV (table 1).

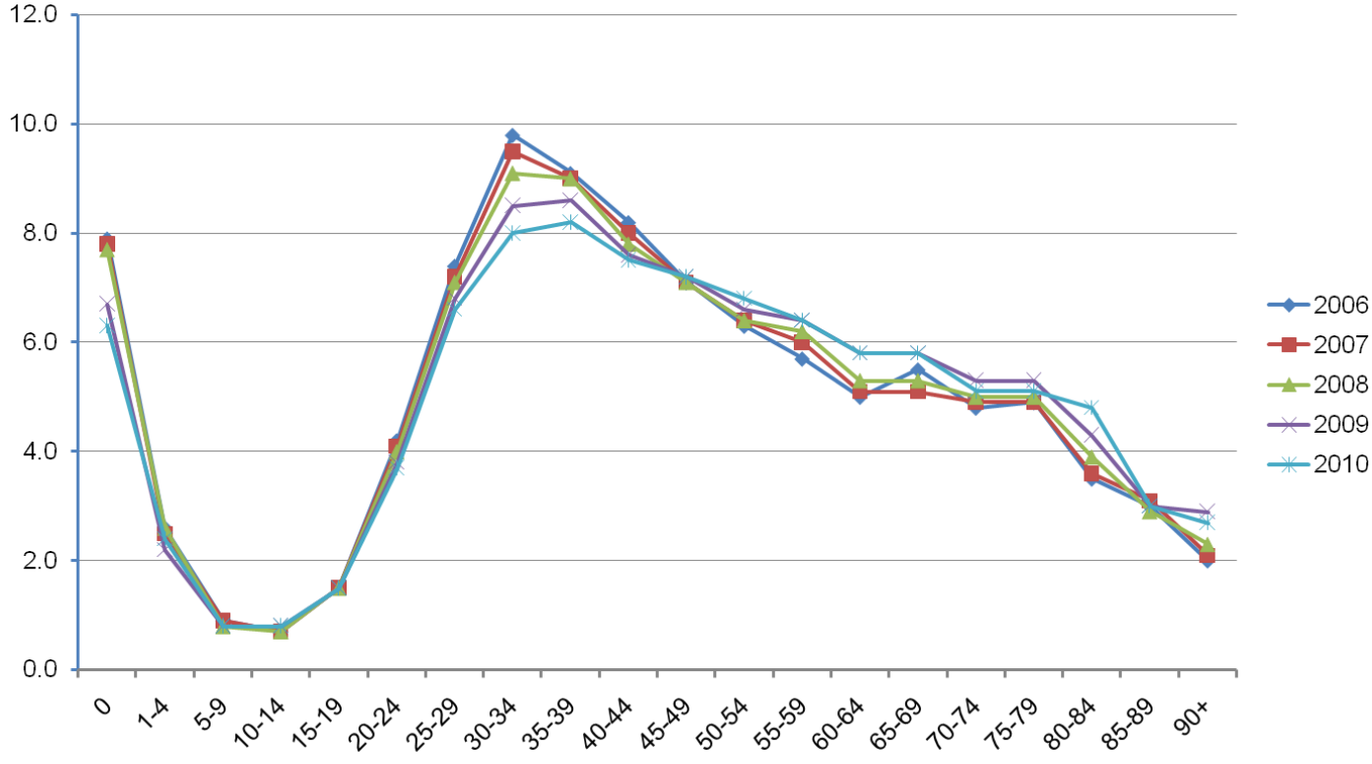
The mortality estimates show that the highest proportions of deaths occurred in the 30-39 year age group (16.2%) during the period 2006-2010, consistent for a region experiencing a generalised HIV epidemic. However, it should be noted that the proportion of deaths in this age group decreased steadily from 18.9% in 2006 to 16.2% in 2010 (figure 1).

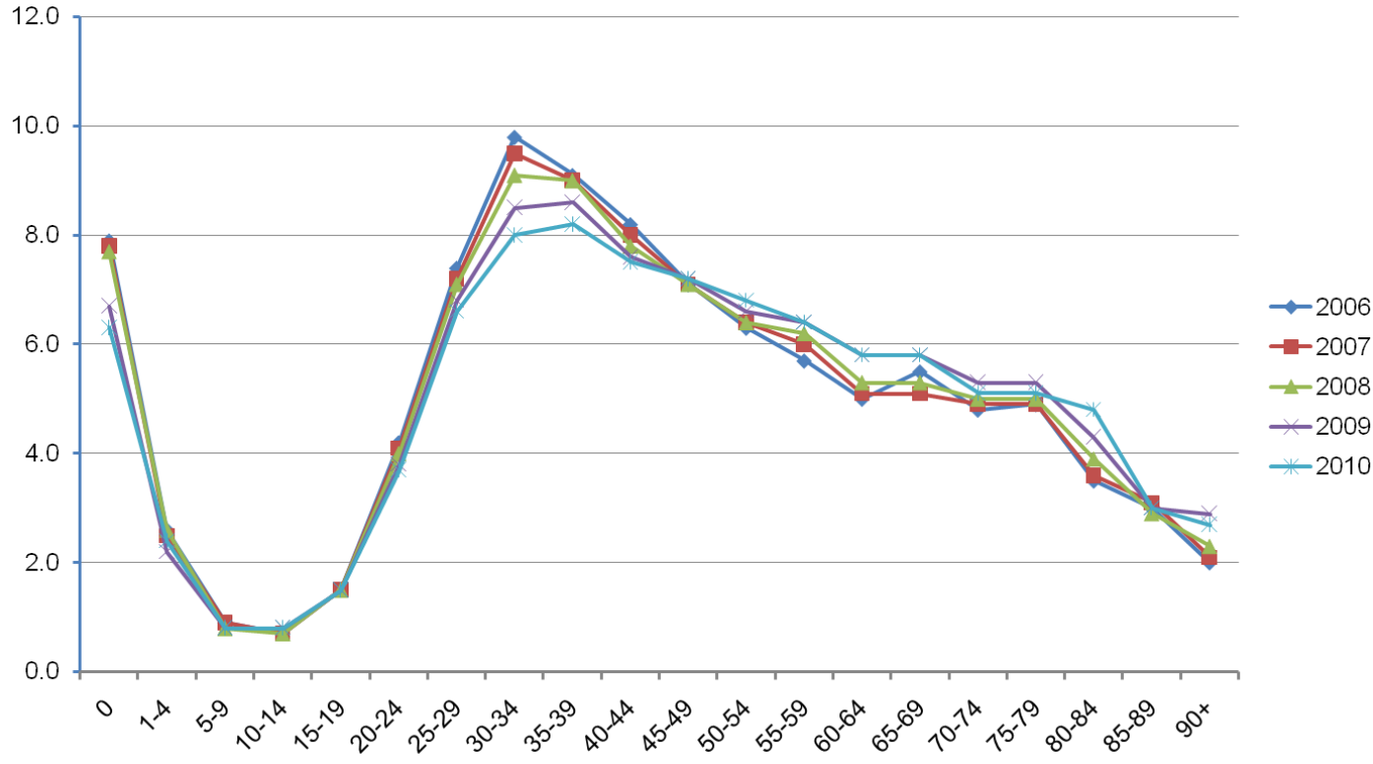
Table 1: Causes of death by case incidence in South Africa by rank, 2008 to 2010. Table adapted from Statistics SA 2010 Mortality Estimates Report.

Causes of death (based on ICD-10)	2008			2009			2010		
	Rank	Number	%	Rank	Number	%	Rank	Number	%
Tuberculosis (A15-A19)*	1	75,281	12.6	1	69,791	12	1	62,827	11.6
Influenza and pneumonia (J09-J18)	2	45,826	7.7	2	43,449	7.5	2	39,027	7.2
Intestinal infectious diseases (A00-A09)	3	39,530	6.6	3	31,070	5.4	3	27,383	5
Other forms of heart disease (I30-152)	4	26,327	4.4	4	26,738	4.6	4	25,827	4.7
Cerebrovascular diseases (I60-I69)	5	24,473	4.1	5	25,062	4.3	5	24,664	4.5
Diabetes mellitus (E10-E14)	6	19,636	3.3	6	20,680	3.6	6	21,475	3.9
HIV disease (B20-B24)	7	15,179	2.5	7	17,785	3.1	7	18,325	3.4
Hypertensive diseases (I10-I15)	10	14,236	2.4	8	15,486	2.7	8	14,890	2.7
Chronic lower respiratory diseases (J40-J47)	9	14,338	2.4	9	14,334	2.5	9	13,099	2.4
Other viral diseases (B25-B34)							19	12,332	2.3
Certain disorders involving the immune mechanism (D80-D89)	8	14,728	2.5	10	13,256	2.3			
Other natural causes		252,720	42.4		251,777	43.4		235,630	43.3
Non-natural causes		53,350	9		50,283	8.7		48,377	8.9
All causes		**596,624**	**100**		**579,711**	**100**		**543,856**	**100**

*including deaths due to MDR-TB and XDR-TB

Figure 1: Percentage distribution of death by age and year, South Africa, 2006-2010. Adapted from Statistics SA 2010 mortality estimates report.





While the proportion of completed death registrations is high (estimated to be 93%, with late registration ~2%), HIV/AIDS-related deaths are substantially under-reported. Data quality hampers the utility of the database because up to 45% of death certificates contain errors.[11] Stigma associated with HIV infection, low HIV testing uptake, fears over health insurance benefit loss and confidentiality have been identified as causes for poor data quality.

Groenewald et al.[12] attempted to estimate the degree of misclassification of HIV/AIDS deaths in the vital registration system by examining increases in age-specific mortality patterns over time for HIV indicator illnesses that matched the age-specific mortality pattern of HIV deaths. Nine other diseases were found to match the age pattern of HIV deaths.[12] The misclassified deaths were added to those classified as HIV related through vital registration.

The Medical Research Council Burden of Disease Research Unit (MRC BoD) assists with the collation and analysis of South African mortality reports. They have made great strides in adjusting reported figures using different approaches in order to improve the outputs.[13-16] Substantial errors on the death notification forms (DNF) have been identified, with a third of these serious enough to affect the identification of underlying cause of death. In another study the MRC BoD compared information obtained from medical records against cause-of-death on the DNF and found that only 50% were in agreement.[17] By introducing correction factors for key diseases, it became apparent that HIV had been under-reported by 53.6% (12% vs. 18.4% cause-of-death from DNF vs medical records respectively) and that TB had been over-reported by 26.8% (5.8% vs. 4.3%). It was also established that a cause of death could be allocated in 81% of cases where no cause had been defined.

Modelling HIV mortality

There are three different models that have been used to estimate HIV mortality across South Africa. These models rely on prevalence data from the antenatal and household surveys as well as programme data as inputs. The latest Actuarial Society of South Africa (ASSA) estimates released in 2011 and using the 2008 model estimated that HIV/AIDS-related mortality decreased from 257,000 in 2005 to 194,000 in 2010.[18] This differs from the UNAIDS SPECTRUM model that estimated AIDS-related mortality stabilising at ~350,000 deaths per annum until 2010 and then declining rapidly to 24,000 in 2011.[19] The Thembisa model estimated 145,000 (95% CI: 134,000-156,000) AIDS-related deaths in 2011/2012.[20] These three models vary because of differing assumptions, but, importantly, they are only as good as the data that inform them. They all rely on estimates of the number of people receiving ART to calculate estimates of mortality rates. For these models to be accurate, it is critical that the underlying data used are accurate, and that they take into account patients accessing ART from more than one site, ART adherence, and retention in ART programmes.

Comparison of national mortality reports and modelled estimates

Compared to all three modelling estimates, the Stats SA / vital registration system reported HIV mortality numbers that were approximately 10-20 times lower than expected for 2010. Even after assuming all 134,678 (24.8%) deaths from infectious diseases and 73,149 (13.5%) deaths due to unspecified causes were attributable to HIV, this number is still far short of the 190,000 to 340,000 deaths predicted/estimated by mathematical models for 2010.

Conclusion and recommendations

The number and proportion of HIV/AIDS related deaths has been and is likely to be substantially underestimated. There are significant disparities between the estimates of HIV-AIDS related mortality in South Africa. This true for comparisons between the modelled estimates as well as comparisons between modelled estimates and vital registration sources.

Measurement of HIV/AIDS related deaths is critical for monitoring the impact of HIV/AIDS public health interventions. Building locally enhanced mortality surveillance systems with a focus on data quality is necessary in order to improve cause-of-death reporting in South Africa. In addition, training of doctors in death certification, a review of the confidentiality of HIV-related death notifications as well as an exploration of societal barriers to accurate vital death registration are necessary steps to improve cause-of-death reporting. It is also important to review the accuracy of the ART coverage data that inform models that estimate mortality so as to ensure accuracy.

References

1. Shisana O, Rehle T, Simbayi LC, Zuma K, Jooste S, Zungu N, Labadarios D, Onoya D et al. (2014) South African National HIV Prevalence, Incidence and Behaviour Survey, 2012. Cape Town, HSRC Press.
2. Hogg RS, Heath KV, Yip B, Craib KJP, O'Shaughnessy MV, Schechter MT, et al. Improved survival among HIV-infected individuals following initiation of antiretroviral therapy. *JAMA* 1998; 279: 450-4 doi: 10.1001/jama.279.6.450 pmid: 9466638.
3. The Antiretroviral Therapy in Lower Income Countries (ART-LINC) Collaboration. ART Cohort Collaboration (ART-CC) groups. Mortality of HIV-1-infected patients in the first year of antiretroviral therapy: comparison between low-income and high-income countries. *Lancet* 2006; 367: 817-24 doi: 10.1016/S0140-6736(06)

68337-2 pmid: 16530575.

4. Abbas UL, Anderson RM, Mellors JW. Potential impact of antiretroviral therapy on HIV-1 transmission and AIDS mortality in resource-limited settings. *J Acquir Immune Defic Syndr* 2006; 41: 632-41 doi: 10.1097/01.qai.0000194234.31078.bf pmid: 16652038.
5. Blacker J. The impact of AIDS on adult mortality: evidence from national and regional statistics. *AIDS* 2004; 18: S19-26 pmid: 15319740.
6. Herbst AJ, Cooke GS, Bärnighausen T, KanyKany A, Tanser F, Newell M. Adult mortality and antiretroviral treatment roll-out in rural KwaZulu-Natal, South Africa. *Bull World Health Organ* 2009; 87:754-762. doi: 10.2471/BLT.08.058982.
7. Goga AE, Dinh TH, Jackson DJ for the SAPMTCTE study group. Evaluation of the effectiveness of the national Prevention of Mother-to-Child Transmission (PMTCT) programme measured at six weeks postpartum in South Africa, 2010. South African Medical Research Council, National Department of Health of South Africa and PEPFAR/US Centers for Disease Control and Prevention, 2012.
8. National Strategic Plan on HIV, STIs and TB: 2012-2016, National Department of Health of South Africa, 2012.
9. Mortality and causes of death in South Africa, 2010: Findings from death notification. Statistics SA, 2013.
10. Statistics SA 2011 Mortality Estimates. Statistics South Africa, Pretoria, South Africa.
11. Birnbaum JK, Murray CJ, Lozano R. Exposing misclassified HIV/AIDS deaths in South Africa. *Bull World Health Organ*. 2011; 89(4):278-85. doi: 10.2471/BLT.11.086280.
12. Groenewald P1, Nannan N, Bourne D, Laubscher R, Bradshaw D. Identifying deaths from AIDS in South Africa. *AIDS* 2005; 19(2):193-201.
13. 2008 Cause of Death by Province, MRC. Medical Research Council, Pretoria, South Africa.
14. 2010 Cause of death statistics for South Africa: Challenges and possibilities for improvement. Available from: http://www.mrc.ac.za/bod/cause_death_statsSA.pdf.
15. Nojilana B, Groenewald P, Bradshaw D, Reagon G. Quality of cause of death certification at an academic hospital in Cape Town, South Africa. *S Afr Med J* 2009; 99(9):648-52.
16. 2010 Western Cape Mortality Profile. Available from: http://www.mrc.ac.za/bod/WC2010Report.pdf. Accessed 16 August 2014.
17. Bradshaw D. Cause of Death certificates for South Africa: challenges and possibilities for improvement. MRC BoD, 2010.
18. Actuarial Society of South Africa. ASSA 2008 AIDS and Demographic Model; 2011. Available from: http://aids.actuarialsociety.org.za/models-3145.htm. Accessed 16 August 2014.
19. Stover J. Updates to the Spectrum/Estimation and Projection Package (EPP) model to estimate HIV trends for adults and children. *Sex Transm Infect* 2012; 88:11–i16. doi:10.1136/sextrans-2012-050640.
20. Johnson L. THEMBISA version 1.0: A model for evaluating the impact of HIV/AIDS in South Africa, University of Cape Town, 2014.