Published on *Treatment Action Campaign* (http://tac.org.za/community)

HIV incidence in South Africa: what is really happening?

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Created *2010/07/08 - 10:57am*
8 July, 2010 - 10:57 ? moderator

Joint statement by Centre for Infectious Disease Epidemiology & Research, School of Public Health and Family Medicine, University of Cape Town; Medecins sans Frontieres; Treatment Action Campaign and SECTION27

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6 July 2010

HIV incidence is the measure of how many new HIV infections there are over a period of time. Measuring changes in HIV incidence is key to evaluating the effectiveness of prevention interventions ? including the provision of antiretroviral treatment (ART), which has been shown to reduce transmission ? as well as for quantifying the need for future services, which is important for planning and budgeting. One of the targets of South Africa?s HIV National Strategic Plan is to reduce HIV incidence by half from 2007 to 2011.

HIV prevalence, on the other hand, is the proportion of the population that is living with HIV at a given point in time, regardless of when they were infected. Therefore, prevalence is influenced by the incidence (the number of new cases) and the length of time that people with HIV live. HIV prevalence will increase as availability of ART increases since people with HIV taking ART live for longer, and will decrease as people with HIV die. To understand how the HIV epidemic is progressing and how well our prevention and treatment programmes are working, we need to know about changes in incidence.

The Human Sciences Research Council (HSRC) has published an article that shows no statistically significant decline in incidence in people aged 15 to 49 from 2005 to 2008 compared to the period 2002 to 2005. However it does show a significant decline in HIV incidence in women aged 15 to 24 over these same periods. The HSRC paper highlights the importance of measuring HIV incidence and encourages further research and dialogue on the reasons why HIV incidence may be decreasing [1].

There is supporting evidence that HIV incidence in South Africa may be decreasing, albeit that it remains very high. Mathematical models that have been based on measurements of HIV prevalence over time show that HIV incidence peaked in 1999 and has declined since then [2]. Various factors may have contributed to this decline, such as the epidemic hitting its natural peak, the impact of ARV scale-up (about 1 million people have initiated treatment in South Africa) and/or prevention efforts focused on behaviour change (there is evidence that condom use is increasing) [3]. However, the contribution of these and other factors is speculative and more research is needed to understand this better.

Measuring incidence is difficult, particularly in South Africa which has historically faced challenges with collecting reliable data of the number people living with HIV and the number of people on treatment. This has cast doubts over

the accuracy of prevalence measures in the past, which in turn casts doubts over the accuracy of incidence estimates when they are calculated from prevalence as is done in the HSRC article. More robust collection and analysis of data by government, in collaboration with academic and non-governmental institutions, is of critical importance ? not only for monitoring incidence trends, but also for understanding the reasons behind changes in these trends.

More research is necessary to demonstrate the impact of scaling up treatment and prevention interventions, as well as to guide policy and funding decisions in future. A decline in incidence does not mean that the HIV crisis is over ? rather, it would suggest either a natural progression of the epidemic or that the investment in treatment and prevention is paying off and needs to be sustained and increased in future if continued progress is to be seen. Given the evidence that treatment reduces sexual and vertical transmission of HIV, the funding cuts by international donors that have threatened the sustainability of ARV programmes will not only affect the health and lives of people living with HIV, but threaten to reverse the welcome trends in incidence that we are now beginning to see.

We call for more research and improved data management to strengthen the underlying assumptions and measurements on which national incidence calculations are based, as well as to improve the analysis of factors that contribute to changes in incidence.

We also call for the HSRC to make the data from the three National HIV Behaviour and Health Surveys publicly available so we can work together on understanding the epidemic as it changes, and on identifying and strengthening the interventions that are shown to have the greatest impact on preventing new infections.

Review of *A Decline in New HIV Infections in South Africa: Estimating HIV Incidence from Three National HIV Surveys in 2002, 2005 and 2008*

Methodology

The HSRC authors used a technique based on a relatively new mathematical methodology to calculate HIV incidence. While the mathematics is complex, the underlying concepts are not too difficult to understand.

The HSRC conducted country-wide surveys in 2002, 2005 and 2008. These surveys measured HIV prevalence. HIV prevalence is the proportion of the population that is HIV-positive at a given time. By examining differences in prevalence across surveys it is possible to estimate the number of new infections (i.e. incidence).

Ideally incidence would be measured by following a large group of people over time and seeing how many of them become infected with HIV. This is unfortunately impractical at a national level.

Different people participated in each of the three HSRC surveys, but nevertheless, it is reasonable to assume that if the surveys were properly conducted then the people in the 2002 survey of a particular age were similar to people in the 2005 survey of the same age plus three years. Likewise the people in the 2005 survey could be assumed to be similar to the people three years older in the 2008 survey. This is what the HSRC researchers assumed. They calculated the change in prevalence for people of a particular age in 2002 to those three years older in the 2005 survey. This almost calculates the incidence for that period, except that it does not take into account that some people with HIV would have died. How the researchers accounted for this is explained below. The researchers then did exactly the same thing for the 2005 to 2008 period. The researchers then compared the difference in incidence between the two periods.

Taking deaths into account

When people with HIV die, HIV prevalence decreases. So the change in prevalence between 2002 and 2005 and from 2005 to 2008 is not only affected by new infections but also by deaths of people with HIV. To calculate incidence, you have to remove the effect of HIV deaths decreasing prevalence. Calculating these deaths is difficult and it was further complicated because ART, which increases the length of time people with HIV live, was scaled up from 2004 to 2008. The researchers were helped by the fact that the 2008 survey checked for antiretrovirals in the blood. The researchers also made an assumption that people initiate treatment one year before they would otherwise have died. They then made a complex calculation of the effect deaths of people with HIV had on prevalence. This then enabled them to calculate incidence.

Results

In the article the researchers calculate a reduction in incidence of 35% among South Africans aged 15-49. However, the confidence intervals for these two estimates overlap[1] and the reduction is not statistically significant and might be due to chance.

Nevertheless, the researchers did find that for a subset of the population, women aged 15 to 24, there was a statistically significant reduction in incidence. In the 2002-2005 period the incidence was estimated to be 5.5 per 100 person-years. It declined by 60%, to 2.2 per 100 person-years in the 2005-2008 period.[2] Here the confidence intervals do not overlap. Provided the estimates are unbiased the difference is likely to be meaningful and not due to chance.

Limitations

The methodology of this study is sound. However, the accuracy of the incidence calculations are only as good as the underlying data used and the assumptions made. There are several limitations with the data:

· The 2002 HSRC survey was the first of its kind. It was widely criticised for having a low response rate and anomalous results. The accuracy of the results of this study is dependent on the accuracy of the 2002 survey. There is great uncertainty about the accuracy of the prevalence estimates of the 2002 survey and consequently there must be great uncertainty about the 2002 to 2005 incidence estimate.

· The method used to calculate the 95% confidence intervals assumes the data were collected in a simple random sample, but the data was from clustered samples. Therefore, the confidence intervals around the estimates of incidence should be larger.

· The researchers make some assumptions, some of them implicit, regarding the effects of antiretroviral treatment, such as the length of time people would have lived if they did not access ART as well as about the scale up of antiretroviral treatment from 2004 to 2008. Therefore their calculation of the number of people with HIV who died between surveys has a wide margin of error.

References

1. Rehle et al. 2010. A Decline in New HIV Infections in South Africa: Estimating HIV Incidence from Three National HIV Surveys in 2002, 2005 and 2008. PloS ONE 5(6): e11094. Doi:10.1371/journal.pone.0011094

2. Dorrington et al. 2006. The Demographic Impact of HIV/AIDS in South Africa. National and Provincial Indicators for 2006. Cape Town: Centre for Actuarial Research, South African Medical Research Council and Actuarial Society of South Africa.

3. Republic of South Africa. 2010. Country Progress Report on the Declaration of Commitment on HIV/AIDS ? 2010 Report.

1 95%CI: 1.2?3.0 per 100 person years for the 2002-2005 period versus 0.6?2.5 for the 2005-2008 period.

2 95%CI: 4.3?6.6 per 100 person years for the 2002-2005 period versus 1.3?3.1 for the 2005-2008 period.

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