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Ageing with HIV in South Africa

Jan AC Hontelez^{1,2,3}, Mark N Lurie⁴, Marie-Louise Newell³, Roel Bakker¹, Frank Tanser³, Till Bärnighausen^{3,5}, Rob Baltussen², and Sake J de Vlas¹

¹Department of Public Health, Erasmus MC, University Medical Center Rotterdam, Rotterdam, Netherlands ²Nijmegen International Center for Health System Analysis and Education, Department of Primary and Community Care, Radboud University Nijmegen Medical Centre, Netherlands ³Africa Centre for Health and Population Studies, University of KwaZulu-Natal, Somkhele, South Africa ⁴Department of Community Health and the International Health Institute, Warren Alpert Medical School, Brown University, Providence, RI, USA ⁵Department of Global Health and Population, Harvard School of Public Health, Boston, USA

Abstract

We used an established microsimulation model, quantified to a rural South African setting with a well-developed antiretroviral treatment program, to predict the impact of antiretroviral therapy on the HIV epidemic in the population aged 50+. We show that the HIV prevalence in patients aged 50+ will nearly double in the next 30 years, while the fraction of HIV infected patients aged over 50 will triple in the same period. This ageing epidemic has important consequences for the South African health-care system, as older HIV patients require specialized care.

Keywords

HIV; Antiretroviral therapy; Ageing; Mathematical model; Epidemiological trends

Introduction

Antiretroviral therapy (ART) is changing the character of the HIV epidemic in sub-Saharan Africa. At the individual level, ART has increased survival of those infected. At the population level, widespread availability of ART could result in the overall ageing of the infected population. ART use in sub-Saharan Africa is expanding rapidly, with an estimated 3.9 million patients on treatment in 2009 [1]. Estimates show that there are already about 3 million people over 50 years living with HIV in sub-Saharan Africa [2]. Recently, Mills *et al* argue for more attention to be paid to HIV infected older people in terms of prevention and care [3]. In the United States, estimates from the CDC show that about 29% of the entire population living with HIV was aged over 50 years in 2008 [4], and projections show that in about 5 years time, more than half of all HIV infected patients will be aged over 50 years [5]. Although it is clear that the number of HIV infected elderly (aged over 50) in sub-Saharan Africa will rise as a result of the ART roll-out, the magnitude of this phenomenon has not yet been quantified. One of the countries most likely to be confronted with this

Corresponding Author: Jan A. C. Hontelez, Department of Public Health, Erasmus MC, University Medical Center Rotterdam, P.O. Box 2040, 3000 CA, Rotterdam. j.hontelez@erasmusmc.nl, Tel: (+31) (0)30 704 46 32.

Contributors: JACH, MNL, and SJdV performed the main analysis, interpreted the results and drafted the manuscript. RB (1) assisted in developing the model and interpreting the results. MLN, FT, TB and RB (2) assisted in interpreting the results and drafting the manuscript.

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shifting epidemic is South Africa, where nearly 6 million people are estimated to be HIV infected, of whom 970,000 were on ART in 2009 [6]. HIV prevalence in the population aged over 50 in South Africa is estimated at about 9% [2, 7].

Methods

To predict the impact of the current ART roll-out on age- and sex-specific HIV prevalences in South Africa up to 2040, we used an established mathematical model (STDSIM) that simulates individuals in a dynamic network of sexual contacts [8, 9]. The model is tailored to the Hlabisa sub-district in KwaZulu-Natal, South Africa (Supplementary Digital Content). This area has a high HIV prevalence [10] and a well-developed ART program [11, 12]. In the model, the survival of ART-naïve HIV infected patients is on average 10 years. We assumed ART to increase survival from start of treatment by a factor 3 and decrease infectivity by 92%, as observed in recent studies [13, 14]. We assumed ART to be initiated at CD4 cell counts of > 200 cells/ μ L in the period 2004 - 2010, and > 350 cells/ μ L in 2011, according to the new WHO guidelines [15]. The model contains an age-specific partner change rate, and frequency of intercourse within a sexual relationship. In previous applications of our model [9] decreasing trends of sexual activity by age in the population aged 15-49 were simply extrapolated to the over-50 group because of lack of available data on sexual behaviour in the population aged 50+. This resulted in a negligible level of risk behaviour and HIV-incidence in the over-50 group, which is inconsistent with recent local data in terms of HIV prevalence in this group [7]. Therefore, we now assumed partner acquisition rates to remain at the same level from age 45 onwards, while the frequency of sexual contacts within a relationship is reduced by 25% for those aged over 50. The ART roll-out in Hlabisa is part of the South African national ART roll-out aimed at achieving universal coverage. Therefore, we assume that the impact of ART on the course of the epidemic is not affected by migration.

Results

Figure 1A shows the projected trends in HIV prevalence in the population aged 15-49 and 50+ in Hlabisa. While HIV prevalence in the 15-49 group would more than halve in the period 2010-2040 from 28% to 9%, the HIV prevalence in the population aged 50 years and older is estimated to nearly double in the same period, from about 9% (8% in women; 11% in men) to 17% (16% in women; 17% in men). The total number of HIV infections in those aged over 50 is expected to have increased by 51% in 2025 (49% for men; 53% for women), after which the number of HIV infections in this age group remains relatively stable (figure 1B). The absolute number of HIV infections in the elderly is estimated to even have doubled by 2025 when comparing to 2004, the year the ART roll-out in the area started. As a result, the age distribution of HIV infected patients would change considerably (figure 1C). This is especially true for men, where currently less than 1 in 12 HIV infected people is aged over 50; in 2040 this would be 1 in 4.

Discussion

We show that the number of HIV infected elderly will increase substantially over the coming decades. This will further complicate an ongoing epidemiological transition in South Africa, where projections show that, despite the excess mortality due to HIV, the population aged over 60 years is estimated to more than double by 2030 due to lower all-cause mortality rates [16]. Cardiovascular risk factors are already prevalent among South African adults, with high levels of obesity, hypertension, and cigarette smoking [17]. In addition, HIV infection and ART have been found to be further independent risk factors for cardiovascular diseases and other age-related chronic conditions [18]. The ageing of the HIV

epidemic will also have important consequences for the organization of HIV care and prevention. Treated HIV is a chronic condition interacting with and accelerating ageing. Comorbidities, interactions with other drugs, and drug toxicity complicate antiretroviral treatment in the elderly, who often require individualized regimens and careful monitoring [18]. Furthermore, disease progression increases with age at acquiring HIV, and effectiveness of ART is lower in people initiated at an older age than at younger age [18]

The above-mentioned processes are not accounted for in the model, however, it is unlikely that they will severely affect our results. A reduced effectiveness of ART and thus increased transmission probability of HIV, coupled with the expected lower all-cause mortality [16], may result in an even more substantial increase in the number of HIV infected elderly compared to our model predictions. On the other hand, our assumption that the full WHO treatment guidelines will be implemented in 2011 will result in a slight overestimation of the number of HIV infected elderly, since under the current South African ART policy only pregnant women and TB infected patients are eligible for ART at 350 cells/ μ L, while for others the 200 cells/ μ L threshold remains for the time being. Furthermore, disease progression is generally faster in the elderly [18], but this is likely to have a limited impact on our predictions since these patients often die of other causes. Finally, we did not consider the impact of ART and HIV on the population growth in the area because long-term projections on population size and structure would require additional assumptions regarding future changes in fertility and background mortality rates which are not only influenced by HIV and ART, but also other processes such as economic growth, and political and economic stability.

We used a 92% reduction in infectivity due to ART and a factor 3 increase in ART naive based on the best available estimates, but some argue that this might be overly optimistic [19]. If we assume an 80% reduction instead, HIV prevalence in the population aged over 50 will increase even further to about 26% in 2040, and the total number of HIV infected individuals aged over 50 will have doubled by 2040 (results not shown). Also, increased survival benefits [20] will result in a further increase in the HIV prevalence (to 25% in 2040) and the total number of HIV infected elderly (a 90% increase in 2040 compared to 2010). The proportion of HIV infected patients aged over 50 only changes slightly under these alternative assumptions (results not shown).

In conclusion, we show that the HIV epidemic in South Africa is at a critical turning point. While the number of infections among young people will continue to decline [6], the number of HIV infections in the elderly can be expected to increase by about 50% in the next fifteen years. In the near future this group will need to be an important focus of attention, and creative solutions need to be found to alleviate further stress placed on an already overburdened health system through the increased need for specialized care, and interacting with other public health problems of an ageing population.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

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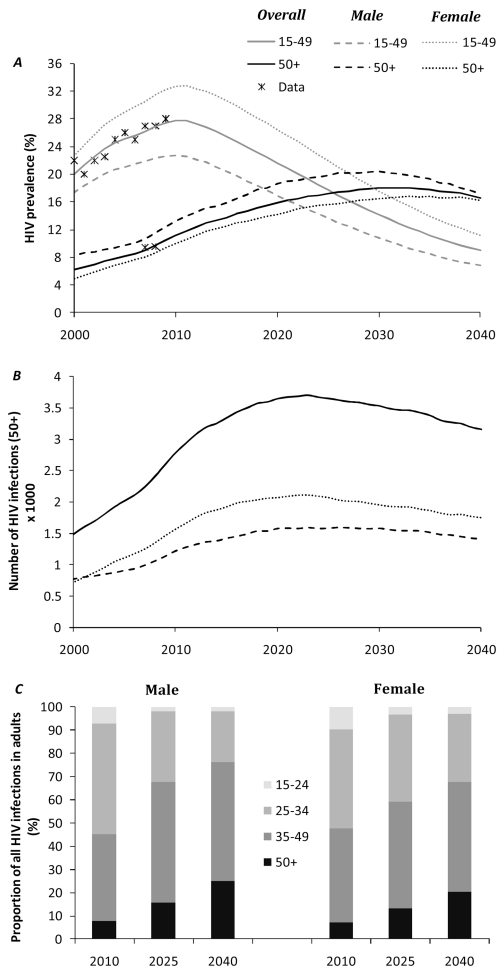


Figure 1. HIV prevalence (in the 15-49 and 50+ age groups), total number of infections, and age distribution of HIV infected patients over the period 2000-2040 in the Hlabisa sub-district of KwaZulu-Natal, South Africa, predicted with the STDSIM model
A = HIV prevalence in those aged 15-49 and 50+ years. Data points from HIV surveillance in Hlabisa [5, 7], **B** = Absolute number of HIV infections among the population aged 50+ in the Hlabisa sub-district (total population size approximately 280,000 in 2009), **C** = Age distribution of HIV infected men and women in 2010, 2025 and 2040.