



Health-adjusted life expectancy in HIV-positive and HIV-negative men and women in British Columbia, Canada: a population-based observational cohort study

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Summary

Background We sought to understand whether people living with HIV (PLHIV) ever on highly active antiretroviral therapy (ART) follow a pattern where morbidity is compressed into the last years of life or lessened as people age. We aimed to estimate health-adjusted life expectancy (HALE) among adults living with and without HIV, and examine dependency between causes of comorbidities.

Methods The Comparative Outcomes and Service Utilization Trends (COAST) study is a retrospective cohort of adults (≥ 20 years) including all known PLHIV and a 10% random sample of the general population of British Columbia, and with longitudinal data spanning from April 1, 1996, to Dec 31, 2012. We determined the prevalence of select comorbidities (cardiovascular, respiratory, liver, and renal diseases, and non-AIDS defining cancers because of their high prevalence among PLHIV) by age and sex by use of case-finding algorithms. Deaths were obtained from a vital event registry from British Columbia, Canada. Comorbid-specific HALE was estimated from 20 years of age by HIV status and sex. For each comorbidity, a healthy state was defined as the proportion of life expectancy comorbid-free, and was adjusted on the probability of occurrence of other different comorbidities. The sensitivity of HALE estimates was assessed to the sequencing of select comorbidities for the dependent comorbidity adjustments.

Findings Our sample consisted of electronic health records from 9310 HIV-infected and 510 313 uninfected adults over the period April 1, 1996, to Dec 31, 2012. These individuals contributed 49 605 deaths and 5 576 841 person-years over the study period. At exactly age 20 years, HALE was about 31 years (SD 0·16) among men living with HIV and 27 years (0·16) among women living with HIV. In the HIV-negative population, HALE was around 58 years (SD 0·02) for men and 63 years (0·02) for women. These results seem independent of ordering. However, PLHIV, particularly women living with HIV, had much shorter overall life expectancies than did their HIV-negative counterparts in the general population [29·1 years (SD 0·1) vs 65·4 years (0·1)], and thus spent less time in a healthy state.

Interpretation Although we noted little differences in the levels of morbidity compression by HIV status, PLHIV—especially women living with HIV—spent less time in a healthy state. Expanded service delivery interventions to address complex care needs of ageing PLHIV are crucial to address shorter life expectancies, and improve their healthy states.

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Introduction

Life expectancy in high-income countries has steadily increased since the 20th century because of changes in fertility patterns, advances in medicine, and improved living conditions.¹ This positive shift in years lived emphasises the need for better investigative methods to measure longevity and morbidity,² and to understand changes in health status over an individual's life course more clearly.³ To this end, health adjusted life expectancy (HALE), developed by Sullivan,⁴ is an important way to compartmentalise states of health by characterising the number of years a person can expect to live in good and ill health, while considering age-specific mortality, morbidity, and disability.

Three competing theories help to explain the relation between life expectancy and the length of the healthy state: compression of morbidity, expansion of morbidity,

and dynamic equilibrium.^{5,6} Compression of morbidity assumes that therapeutic and preventive efforts will compress chronic diseases to a shorter period later in life, resulting in reduced periods of disease.⁵ By contrast, the expansion of morbidity attributes advances in medicine to decreased fatality rates, thus increasing prevalence rates.^{5,7} Dynamic equilibrium, however, suggests that although decreased mortality rates lead to an increase in milder chronic diseases, severe chronic diseases will be reduced, resulting in an improved quality of life.⁶

Although these theories highlight the interplay of mortality and morbidity at both individual and population levels, there is an urgent need to determine this relationship within the ageing population living with HIV. Thus, we sought to understand whether this cohort of HIV-positive and negative men and women follow a pattern where morbidity is compressed into the last years

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Research in context

Evidence before this study

Health-adjusted life expectancy (HALE) is an index used to capture morbidity and mortality factors of a population, and can thus be used to understand the effects of HIV and comorbid conditions on an ageing population living with HIV. However, examining all causes of comorbidity in the measure of HALE, without considering people with more than one condition, would overestimate the severity of the time a population is spent in an unhealthy state. We did a systematic review of the scientific literature by searching PubMed, CINAHL (Ebscohost), Global Health (Ovid), Embase(Ovid), and the Cochrane Central Register of Controlled Trials databases for studies published up to Nov 30, 2016. Our search terms included “healthy life expectancy” or “health-adjusted life expectancy” and “comorbidity” or “morbidity” with no language restrictions.

Added value of this study

Using data from the Comparative Outcomes and Service Utilization Trends (COAST) study, we estimated HALE, with adjustment for potential dependent comorbidities for select conditions among people living with HIV (PLHIV) and those living without HIV (HIV-negative) in the British Columbian population. To our knowledge, this is the first study to characterise the length of the health state for both PLHIV and HIV-negative individuals, as well as the effect of dependent comorbidities on the measurement of HALE. Age-specific

morbidity rates were calculated by dividing the number of people with select comorbidities by the number of person-years over the study period, and reported by age group and sex. Because of their prevalence among PLHIV, we chose to study the following key comorbid conditions: cardiovascular disease, respiratory disease, liver disease, renal disease, and non-AIDS defining cancers. More than half of comorbidities reported are paired or dependent with another condition. In the case of PLHIV, we found comorbidities were mostly paired with liver and renal diseases, whereas they were paired with cardiovascular diseases in the HIV-negative population. The ordering of comorbidity pairs has little effect on the estimation of HALE; however, these adjusted HALE measures are noticeably higher, and the time spent in an unhealthy state is much shorter than the unadjusted measures.

Implications of all available evidence

After adjustment for codependencies, we noted little differences in the levels of morbidity compression between PLHIV and their HIV-negative counterparts; however, men and women living with HIV had reduced life expectancies and measures of HALE. Our findings highlight the urgent need to better address the complex care needs of PLHIV through expanded service delivery targeted at comorbidities and chronic-disease management.

of life or lessened as a function of ageing. We aimed to estimate HALE, with adjustment for codependencies between select comorbidities, among people living with HIV (PLHIV) and those living without HIV in British Columbia, Canada.

Methods

Study design and participants

The Comparative Outcomes and Service Utilization Trends (COAST) study is a retrospective cohort of adults (≥ 20 years) including all known PLHIV and a 10% random sample of the general population of British Columbia, and with longitudinal data spanning from April 1, 1996, to Dec 31, 2012. COAST is based on deidentified health-related data arising from a unique linkage between the BC Centre for Excellence in HIV/AIDS (BCCfE) and the British Columbia electronic repository of administrative health records held by the British Columbia Ministry of Health and other provincial agencies for research, Population Data BC. In this study, our combined dataset for individuals in COAST included physician billings, hospital discharge abstracts, cancer-related diagnoses, and deaths (obtained from British Columbia Ministry of Health databases Medical Services Plan [MSP] Payment Information File, MSP Registration & Premium Billing, Discharge Abstract Database [Hospital Separations], BC Cancer Agency Registry Data, and BC Vital Statistics

Agency Deaths). Additionally, the BCCfE, which centrally manages all antiretroviral prescriptions in the province, provided data for antiretroviral therapy, viral load, and clinical manifestations, such as AIDS defining illness, comorbidities, and mortality.⁸

Two cohorts of individuals aged 20 years and older were created for this study. The PLHIV cohort was constructed from all adults known to be living with HIV in British Columbia who have had a record of at least one detectable HIV plasma viral load and ever been prescribed highly active antiretroviral therapy (ART) in British Columbia between April 1, 1996, and Dec 31, 2012. The HIV-negative cohort was constructed from a 10% random sample of all adults in the total British Columbia population meeting the age criterion between April 1, 1996, and Dec 31, 2012, and with no known HIV diagnosis determined using a previously reported algorithm.⁹ Individuals were followed until the end of the study period.

Ethical approval was obtained from the University of British Columbia/ Providence Health Care (#H09-02905) and Simon Fraser University (#2013s0566) research ethics boards.

Outcomes

The primary outcome variable in our analysis was HALE. This measure estimates the number of healthy years an individual is expected to live at birth by subtracting

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