

Evaluating interventions for HIV treatment and prevention: time to embrace a quality-adjusted life year (QALY) based approach

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Background

QALY: Motivated by the principle of maximizing population health, the use of quality-adjusted life years (QALYs) is ubiquitous in health economic evaluation. The QALY is a measure that defines health in terms of time spent in health states, thus capturing improvements in both morbidity and mortality. Assessments of value from QALY-based cost-effectiveness analyses are directly interpretable, allow for direct comparison across diseases, and are consistent with the theoretical basis of health economic evaluation.

Infections averted: An explicit focus on reducing new HIV infections, for example by the US National HIV/AIDS strategy¹ and the National Institutes of Health², has prompted some to consider HIV infections averted in the denominator of the incremental cost-effectiveness ratio (ICER). While articulating this objective stems directly from the discovery of the secondary preventative benefits of ART, and also the success of PrEP as a new method of prevention, orienting policy and practice to meet this objective instead of using a measure of health benefit such as QALYs may result in sub-optimal decisions and pose serious ethical challenges, as described in more detail below.

Issue: The use of incident HIV cases averted is sometimes framed as being directly interchangeable with the use of QALYs in economic modelling studies. Epidemiological modeling studies often focus explicitly on averting new HIV infections, implicitly aligning with policies guided on this basis. This is problematic for several reasons. Using HIV cases averted provides no opportunities for comparing value relative to interventions in other disease areas, and we argue here, provides a flawed and ill-conceived perspective on absolute value as well. Most importantly, the immediate and sustained reductions in morbidity and mortality among PLHIV receiving ART are not captured. This implicitly places greater value on the lives of individuals at risk of contracting HIV/AIDS than those infected.

Objective: We demonstrate the health and ethical implications of using HIV infections averted, as opposed to QALYs gained, in judging the relative value of HIV treatment and prevention interventions using a case example from British Columbia (BC), Canada.

Methods

Study design: A cost-effectiveness analysis built off a model-based evaluation of HIV care interventions presented elsewhere³

Model: A dynamic transmission model that was previously applied to estimate the health benefits and costs of HIV interventions in the United States⁴, BC^{5,6} and China⁷

Setting: British Columbia (BC), Canada

Interventions: All 15 possible combinations of the interventions considered in the "Seek and Treat for Optimal Prevention of HIV/AIDS" (STOP HIV/AIDS) initiative in BC

Comparator: The counterfactual 'status quo' scenario with no additional public health investment

Perspective: Third-party payer

Costs: All direct medical and program costs, in 2015 \$CDN

Effectiveness measures: a) HIV infections averted; b) QALYs

Study period: 28 years, 2011-2038

Discount rate: 3% for both costs and QALYs

Health production function: Plotting incremental cost (x-axis) and benefit (y-axis) for valuation using the two effectiveness measures, and only strategies lying along the health production function were compared to the next-most resource intensive strategy

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Results

- With HIV infections averted in the y-axis (Fig 1, Panel A), ED testing, ED + hospital-based testing, all primary care testing and the combined interventions lie on the health production function.
- With QALYs in the y-axis (Fig 1, Panel B), ED testing, ED testing + ART initiation, ED + hospital-based testing + ART initiation, and the combination of all the interventions assessed lie on the health production function.
- Without regard for total budgetary impact, the combination strategy would be chosen in both cases. An estimated 516 HIV infections would be averted, including 116 observed in the first 10 years of the study period, 223 observed in the next 10 years, and 177 observed in the final 8 years.
- If the total available funding for the 28-year period is capped at \$40 million, a QALY-based approach would identify ED + hospital-based testing + ART initiation as the optimal strategy, while 'all primary care testing' would be chosen by attempting to minimize new infections. This decision would result in a net loss of 297 QALYs, borne exclusively by PLHIV.

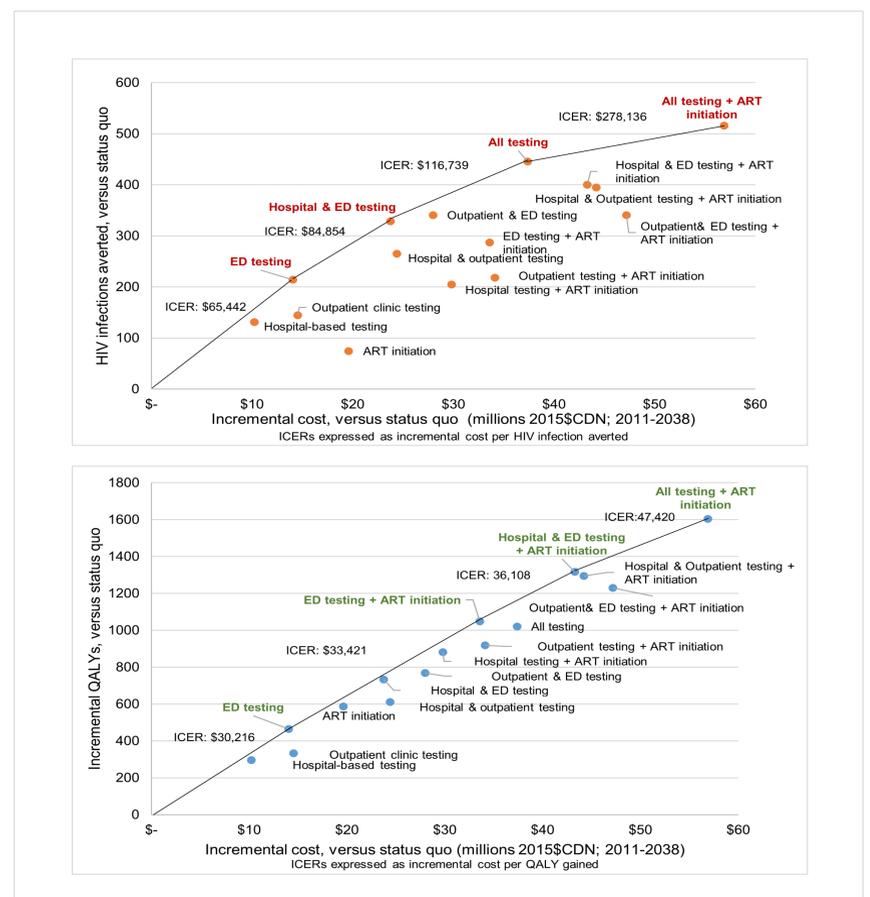


Fig 1. Health production functions to select the optimal combination of HIV care interventions in BC (2011-2038). (A) Selection on the basis of infections averted. (B) Selection on the basis of QALYs gained.

Discussion

Using HIV infections averted in the denominator of ICER calculations to assess the relative value of a set of HIV care interventions resulted in a different set of 'optimal' interventions identified, as opposed to the evidence-based standard QALY. It should be clear from this exercise that using HIV infections averted in the denominator of the ICER undervalues the full benefits of ART, fully ignoring the direct individual-level benefits to PLHIV through delaying or reversing disease progression and thus extending life.

The use of incident HIV cases averted as the primary measure of effectiveness in health economic evaluation is potentially misleading and antithetical to the central principle of health economic evaluation: that resource allocation decisions should be made toward optimizing the health of the population. It is imperative that local, national and international public health agencies adopt QALYs as the basis for selecting interventions to reduce HIV-related morbidity, mortality and transmission, and thus maximize population health.

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