

Economic evaluations of HIV prevention in rich countries and the need to focus on the aging of the HIV-positive population

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Purpose of review

The Centers for Disease Control and Prevention has stressed testing as a prevention program for HIV/AIDS. Data on the effectiveness of these efforts are now available. The advent of successful antiretroviral (ARV) therapies and longer life expectancies has resulted in an emerging cohort of older adults with HIV. Due to differences in life expectancies and the availability of ARVs in rich and poor countries, the growth in the older population with HIV is not universal, although this situation is changing due to policies advocated by the UN for universal access to ARVs.

Recent findings

The literature on differences in access to ARVs of those with HIV in rich and poor countries, and the efficacy of ARVs in reducing opportunistic infections and AIDS-related comorbidities, is still emerging. The current study reviews findings relative to the benefits and effectiveness of testing as a prevention strategy and highlights the impact of age on HIV testing, and the need for more evaluations in this area.

Summary

HIV testing and prevention are effective in older adults. More education and outreach is needed on HIV risk in this population to healthcare providers and older adults themselves. HIV prevention materials need to be age-appropriate in order to be effective in the older population.

Keywords

economic evaluations, elderly adults, HIV, prevention

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Introduction

We survey recent economic evaluations of HIV/AIDS preventive interventions in rich countries, mainly focusing on the experience in the USA. An important difference between rich and poor countries is that antiretrovirals (ARVs) have been administered to a larger share of the AIDS-infected populations in resource-abundant societies. The more people on ARVs, the lower the mortality rates and the greater the share of the population who will live longer. So rich countries have a larger percentage of their HIV populations that are elderly. In the first section we highlight this difference and examine the link between aging and ARVs. Then we examine the preventive role of ARVs. The Centers for Disease Control and Prevention (CDC) have identified a number of types of intervention that have been effective. Testing has been given special emphasis. In the third section we review the results for these CDC preventive interventions. We distinguish economic evaluations that do and do not value outcomes in monetary terms. In the final section we explain the need to expand the scope of

interventions and their evaluations so that they include prevention programs for elderly persons.

HIV, antiretrovirals and aging in richer countries

Since the introduction of ARVs in the 1990s, there has been an extraordinary decrease in mortality and increase in life expectancy among people with HIV [1^{••}]. In the USA, this situation has resulted in an HIV population that is growing and graying [2^{••}]. From 2001 to 2007 the number of people 50 years and older living with AIDS nearly doubled, rising from 67 901 to 131 670. More than 70% of those with HIV are over age 40 and nearly 27% of people living with AIDS in the USA are over age 50 [3,4[•]]. By 2015 half of all people living with HIV in the US will be over the age of 50 [5[•]].

These patterns are seen in richer nations, but in poorer nations (e.g. sub-Saharan Africa), the aging of the HIV population is not yet evident. Richer nations have a higher proportion of older adults due to higher life

expectancies, whereas poorer nations have lower life expectancies often due to the HIV/AIDS pandemic [6]. In addition, the cost of ARV therapies limits access to this treatment in many poorer countries [7]. But ARV treatments show similar gains in life expectancy once they are initiated in rich and poor countries alike, being approximately 23 years in adults following ARV initiation [1[•],8]. However, new infections in the 50 and older age group also contribute to the aging of the HIV population. HIV is now being transmitted within the older adult population accounting for 15% of new cases annually [9[•]]. There have been scant efforts by the government to fund delivery or development of age-appropriate HIV prevention messages to older adults.

Adherence to ARVs plays a role in secondary HIV prevention, by reducing viral load and thereby reducing the chance of infecting others. In richer countries, nonadherence results from the side effects of the ARVs themselves, and psychosocial factors such as comorbid mental health problems (e.g. depression, substance/alcohol use), a history of trauma/ abuse, and stigma [10^{••}–13^{••}]. These factors are widespread in the HIV population and often are undiagnosed and untreated. Depression and substance use are also prominent in the older population with HIV [14^{••},15^{••}]. But beyond adherence, the effectiveness of ARVs is negatively affected by depression and substance use, which can result in higher viral loads [16^{••}]. Adherence in poorer countries is also affected by depression, but also by economic factors such as transportation, competing demands for scarce economic resources (e.g. food), and running out of medication [17[•],18^{••}].

Types of prevention and antiretroviral treatment as prevention

The CDC sets the main guidelines for HIV policy in the US. The CDC's budget in FY09 for HIV prevention was approximately US\$750 million, which accounts for 4% of all federal HIV/AIDS spending on the US epidemic. In their summary of the status of prevention in the USA, as of August 2009, they point out that cumulative prevention efforts have led to more than 350 000 HIV infections being averted and savings in medical costs alone of US\$125 billion. At the request of Congress, CDC estimated the impact of additional investment on the epidemic. They project that with an additional US\$877 million in annual prevention funding, the HIV transmission rate could be halved in just over a decade [19[•]]. The CDC listed the following as being proven HIV prevention interventions: HIV testing, reducing risk behaviors among those who are HIV positive, facilitating confidential identification and notification of partners, ARV treatment, substance-abuse treatment, access to condoms and sterile syringes, and screening for other sexually transmitted diseases. Given that most (53%) new

infections are due to men who have sex with men (MSM), and this risk group is the only one in which infections are increasing in the USA, it is very interesting that male circumcision was not listed as a proven prevention strategy. This factor is presumably because of the negative findings for male circumcision in the USA [20[•]].

Given that ARVs are a major component of treatment in the USA, every HIV infection that is prevented saves US\$385 200 in the costs of lifetime treatment [21]. As treatment costs get more expensive, the cost of prevention programs becomes even more justified [22]. This situation implies that for richer countries in particular, when every HIV prevention program is being evaluated, it is effectively being paired and compared with treatment programs. If the costs of the particular prevention program are not incurred, the costs of the treatment program will have to be borne instead. ARV treatment is preventive in that it reduces the viral load, which reduces transmission during sexual activities and is also effective for pregnant mothers in eliminating mother-to-child transmission [23]. Recently, ARVs have been evaluated as a preventive intervention in both pre-exposure [24^{••},25^{••}] and postexposure settings [26]. ARV treatment does not only lead to fewer HIV transmissions, it is preventive in the sense of effectively reducing the many opportunistic infections that accompany HIV/AIDS-infected patients [27].

The main CDC guidelines in the USA have involved HIV testing. Up to 2006, the CDC recommended HIV testing for just the high-risk HIV groups. This strategy was thought ineffective because about 25% of people with HIV were unaware of their infection. So in September 2006, the CDC released new guidelines calling for routine, voluntary HIV testing for all persons 13–64 years in healthcare settings. This has been found to be effective [28]. However, if testing was combined with counseling, general testing would avert even more transmissions [29].

Types of economic evaluations and examples in resource-rich economies

Any economic evaluation of an intervention for HIV/AIDS involves four ingredients: inputs, outputs, prices of the inputs, and prices of the outputs [30]. The prices of the inputs applied to the inputs form the 'costs' and the prices when attached to the outputs constitute the 'benefits'. A cost-benefit analysis (CBA) takes the benefits and subtracts the costs to determine the net benefits. If the net benefits are positive, then the intervention is worthwhile and should be funded. Only a CBA can tell for sure whether the intervention is desirable. But, other forms of economic evaluations can be used as short-cut CBAs under special conditions.

The simplest economic evaluation looks at effectiveness, to see if the inputs generate any positive outputs. If an intervention is not effective then it is not worthwhile irrespective of the prices of the inputs and the outputs. Up to now, there are at least 144 HIV prevention programs that have been found to be effective [31•]. A cost-minimization economic evaluation proceeds by assuming that outcomes are identical. With benefits the same, the cost minimization selects as worthwhile the one with the least costs. Greater adherence to ARVs is cost saving by lowering hospital utilization, but it raises total medical costs due to the high cost of ARV therapy [32•]. Genotypic ARV resistance testing led to higher healthcare costs, though including the productivity costs savings due to the enhanced patient ability to work meant that testing lowered overall costs [33].

If prices of outputs are the same across interventions, then a cost-effectiveness analysis (CEA) can be employed to make the economic evaluation using information just on costs and outcomes. The most comprehensive output measure is a quality-adjusted life year (QALY). Under base-case assumptions, the range of costs per QALY, in ascending order, was US\$8200 for expanding methadone treatment for heroin addicts in the high prevalence community and US\$10 900 in the low-prevalence community [34]; US\$12 567 for PEP using zidovudine [25••]; US\$16 000 for prophylaxis for PCP and toxoplasmosis with trimethoprim-sulfamethoxazole [27]; US\$23 000 for three-drug ARV therapy [35]; US\$30 800 for p24 antigen EIA testing for primary HIV infection [36]; US\$31 851 for preventing STDs among high-risk urban women [37]; US\$31 970 for HIV chemoprophylaxis strategies [26]; US\$35 000 for genotypic ARV resistance testing [33]; US\$36 700 for HLA-B*5701 genetic screening [38••]; US\$38 000 for expanded one-time screening, US\$71 000 for testing every 5 years, and US\$8500 for testing every 3 years with ELISA [39]; and US\$298 000 for PrEP using a combination of tenofovir and emtricitabine [26].

A major problem with CEA as a method of deciding priorities for HIV/AIDS interventions is how to decide on the fixed price that one is going to use to value the QALYs that one is producing. Very influential in the USA was the 2001 study [40] that endorsed the earlier one in 1982 [41] which proposed that, for the US\$50 000 be the usual threshold standard for deciding whether an intervention was worthwhile. In Holland €20 000 is the cut-off cost-per-QALY which is low (given foreign exchange rate equivalencies) relative to the US\$50 000 US standard and the £30 000 UK benchmark [42]. When a general threshold standard is not invoked in a CEA, or the outcome used is other than a QALY, the usual benchmark is the cost-effectiveness of other HIV interventions. Thus zidovudine regimens to prevent cases of perinatal HIV

transmission were considered cost effective given the cost per case of treating a pediatric HIV infection [23]. General outcome measures used as alternatives to (or in addition to) QALYS are life-years/survival [28,38••,43,44] and cases averted [29,34,36,37].

Most of the CBAs of HIV/AIDS in rich countries were published at the early stages of the epidemic. Almost all of these involved HIV testing. There were evaluations of blood screening [45] mandatory premarital testing [46], testing, counseling and partner notification [47], routine testing of hospital patients [48] and antibody screening for immigrants [49]. The main reason why the majority of economic evaluations of HIV/AIDS interventions take the form of CEAs is because of evaluators' increasing reluctance to express outcomes in monetary terms to form the benefits part of CBA. This reluctance is a mistake as only a CBA can tell whether interventions are worthwhile (maximizes net social surplus) and CEA implicitly refers to some monetary threshold as mentioned above.

Note that all of the other kinds of economic evaluations use costs for their criteria and many of the considerations on the costs side are the same as with the benefits side, especially if, as under a cost minimization, one is effectively regarding a benefit as a negative cost. Rather the challenge is for the evaluator to decide on the specific method to use for monetarizing the benefits. There are a wide range of alternative methodologies available. The three benefit methods used in the earlier testing economic evaluations were: the human capital approach (discounted lifetime earnings) [45], the value of a statistical life (VSL) [46–48] and benefits as negative costs [49]. A fourth benefit method applied to HIV testing at home involved contingent valuation [50]. Most of the recent benefit applications relate to developing countries [51••–54••]. Two additional benefit methodologies were used. For a condom marketing program, actual market prices were used to construct the benefits [51••] and for ARVs the revealed preferences of a social decision-maker (the Global Fund) [52••]. The six benefit methods just mentioned are the main ones. But, there are many other methods that have been used [55••], so the analyst should be able to find one methodology which s/he is comfortable with and which is the more appropriate for the decision-making problem the study is targeted for.

Expanding HIV prevention efforts and economic evaluations to include older adults

HIV prevention efforts have not targeted older adults [56••]. Thus, many older adults fail to get tested while they still have an early-stage HIV infection. This finding is starkly illustrated by recent data; among adults 50 and older who tested HIV positive, 51% also received an AIDS diagnosis within 12 months as compared with

33% of younger adults [57[•]]. What is disturbing about this high incidence of AIDS diagnoses in the older population is that when a person is HIV positive and has progressed to AIDS, they become highly infectious. A person with HIV on ARV typically has viral levels that are low and undetectable, reducing the risk of infection.

The CDC does not consider adults 50 and older to be at high risk for HIV, and does not recommend routine testing for persons 65 and older [58]. This policy should be changed. In December 2009, the Centers for Medicare and Medicaid Services authorized Medicare reimbursement for routine HIV testing, which will increase the availability of this prevention tool among older adults. What is now needed is a unified and comprehensive response from government and policy makers to prevent the spread of HIV in older adults.

Older adults are not considered a high-risk group because most HIV infections occur between the ages of 25 and 49 [4[•]]. However, recent data indicate that 15% of all new HIV infections occur among those 50 and older, and the proportion is increasing [59^{••},60]. A sizeable minority of HIV-positive older adults continue to engage in unsafe sexual behavior [61^{••},62]. As the number of older adults living with HIV increases, the likelihood of a noninfected person encountering a HIV-positive age-peer increases. It is also likely that there is an under-reporting of HIV cases in the older population given that HIV testing is not emphasized in this group. HIV prevention programs and materials rarely target older adults; most focus on adolescents and young adults. A recent survey found that only 15 out of 50 state departments of health in the USA had publications that specifically addressed HIV and older adults [63]. For example, prevention messages should address issues specific to older adults (e.g. greater risk to women after menopause), appear in larger typeface, and rely on personal messages that are resonant in this population [64]. Thus, there are very few economic evaluations, even in richer countries, that cover interventions related to older adults [65[•]].

Conclusion

Most economic evaluations of preventive interventions in the USA have used a cost-effectiveness framework. There are intrinsic limitations in such an approach as only by measuring outcomes in monetary terms so that they are commensurate with the costs, which is the outcome method used in CBA, can one determine whether any intervention is worth funding. The existing literature of economic evaluations in rich countries needs to be expanded so that it now includes the fastest growing of the HIV-infected populations, that is, those over 50 years of age.

References and recommended reading

Papers of particular interest, published within the annual period of review, have been highlighted as:

- of special interest
- of outstanding interest

Additional references related to this topic can also be found in the Current World Literature section in this issue (p. 262).

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- An economic evaluation using CBA in which the benefits are obtained by valuing lives saved by the present value of lifetime earnings (the human capital approach).
- 55** Brent RJ. *Setting priorities for HIV/AIDS: a cost–benefit approach*. Northampton, Mass: Edward Elgar. 2010.
- This book covers HIV evaluations in rich and poor countries. It shows that HIV/AIDS is much too complex a phenomenon to be understood only by reference to common sense and ethical codes. HIV/AIDS policies need to be evidence based and CBA is the best way to assemble and summarize the evidence.
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- A study in Atlanta, GA found that 39% of women aged 50–54 had been previously tested which decreased to 14% of women aged at least 65 years. Previously tested women had higher HIV knowledge and were more likely to be sexually active, report risk factors, and perceive themselves at risk for HIV.
- 57** CDC [Center for Disease Control and Prevention]. HIV/AIDS surveillance report, 19. 2007. Retrieved December 2, 2008 from the World Wide Web: <http://cdc.gov/hiv/topics/surveillance/resources/reports/2007report/pdf/2007SurveillanceReport.pdf>.
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- The number of persons aged 50 years and older living with HIV/AIDS has been increasing in recent years. As the US population continues to age, it is important to be aware of specific challenges faced by older Americans and to ensure that they get information and services to help protect them from infection.
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- Half of all older adults with HIV in New York City was sexually active, with 40% engaging in vaginal or anal intercourse. Further, 41% of those who were sexually active engaged in unprotected vaginal or anal intercourse, and 21% engaged in high-risk sex.
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