The cost-effectiveness and population outcomes of expanded HIV screening and antiretroviral treatment in the United States

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Record Status
This is a critical abstract of an economic evaluation that meets the criteria for inclusion on NHS EED. Each abstract contains a brief summary of the methods, the results and conclusions followed by a detailed critical assessment on the reliability of the study and the conclusions drawn.

CRD summary
This study examined the cost-effectiveness of expanding screening, antiretroviral therapy, or both to reduce the HIV epidemic in high- and low-risk people aged 15 to 64 years. The authors concluded that the most effective and cost-effective strategy was expanding both HIV screening and treatment, but interventions to halve risk behaviour were also needed to markedly reduce the epidemic. The methods appear to have been valid and should ensure that the authors’ conclusions are robust, despite the use of several assumptions.

Type of economic evaluation
Cost-utility analysis

Study objective
This study examined the cost-effectiveness of expanding screening, antiretroviral therapy (ART), or both to reduce the HIV epidemic in both high- and low-risk people aged between 15 and 64 years.

Interventions
The interventions were combinations of HIV screening and treatment, with various screening frequencies, targeted risk groups, and ART use.

The four expanded screening strategies were: screening of low-risk people once over lifetime and high-risk people annually; screening low-risk people every three years and high-risk people annually; screening everyone every three years; and screening everyone annually.

Expanded ART was a strategy of increasing the use of ART, for those with a cluster of differentiation (CD) 4 cell count of less than 0.350 x 10⁹ cells per L, from 50% to 75%.

Expanded screening and ART included each of the four expanded screening strategies with ART use increased to 75%.

High-risk groups were men who have sex with men (MSM) and drug users. The background comparator was the status quo, which was the natural history of HIV transmission.

Location/setting
USA/primary and secondary care.

Methods
Analytical approach:
The authors modified a previous dynamic mathematical model of HIV transmission to examine the clinical and economic impact of the strategies. A time horizon of 20 years was considered. The authors stated that a societal perspective was adopted.

Effectiveness data:
The clinical data were estimated using selected published sources, which were generally published models, observational studies, and clinical trials. Some epidemiological inputs were from national databases and registries.
The key input was the rate of HIV transmission, which depended on the infected person’s sex, disease status, and treatment status, and the uninfected person’s sex and circumcision status. Some assumptions were required.

**Monetary benefit and utility valuations:**
The utility values were from published sources.

**Measure of benefit:**
Quality-adjusted life-years (QALYs) were the summary benefit measure and they were discounted at an annual rate of 3%.

**Cost data:**
The economic analysis included the costs of screening and counselling, laboratory tests, annual costs of ART, and lifetime treatment of HIV, which was based on disease progression. The costs and resource quantities were mainly from published studies and from Medicare and Medicaid services. All costs were in US dollars ($) and were discounted yearly at a rate of 3%. The price year was 2009.

**Analysis of uncertainty:**
Univariate sensitivity analyses were carried out to examine the impact of variations in the clinical and economic inputs on the model outcomes.

**Results**
In the whole US population, over 20 years, the natural history of HIV transmission resulted in 1,225,380 HIV infections. Compared with this status quo, the incremental costs (in billion) ranged from $25.7 to $71.7 with the expanded screening strategies, were $63.8 with expanded ART, and ranged from $92.6 to $293.1 with the combined strategies. The QALYs (in millions) ranged from 0.5 to 1.6 with the expanded screening strategies, were 3.1 with expanded ART, and ranged from 3.8 to 4.9 with the combined strategies.

After excluding the dominated strategies, which had fewer QALYs and higher costs than another strategy, the incremental cost per QALY gained was $22,383 with screening low-risk people once compared with the status quo, $20,300 with expanded ART compared with the status quo, and $21,580 with screening low-risk once with 75% ART, compared with expanded ART, $192,139 with screening low-risk every three years with 75% ART, compared with low-risk screening once with 75% ART, and $788,706 with screening all annually with 75% ART, compared with screening low-risk every three years with 75% ART.

Screening low-risk once and high-risk annually with 75% ART was the best option, as it provided the highest benefits at an acceptable cost per QALY.

The incidence of HIV was reduced significantly only with programmes aimed at reducing risk sexual behaviour, such as halving the number of sexual partners for men who have sex with men (MSM) or halving needle-sharing frequency for injection drug users. The inputs with the greatest impact on the health outcomes were the screening and treatment effectiveness.

**Authors’ conclusions**
The authors concluded that the most effective and cost-effective strategy was expanding both HIV screening and treatment, but interventions to halve risk behaviour were also needed to markedly reduce the US HIV epidemic.

**CRD commentary**
**Interventions:**
The selection of the comparators was appropriate in that a range of interventions was considered, individually and in combination. They were compared with the status quo, as well as with each other.

**Effectiveness/benefits:**
The clinical data were mostly from published models or other studies that were not fully described. It is likely that the authors selected the most appropriate studies that they knew about, but it is difficult to judge the validity of these
sources given the lack of detail. An extensive sensitivity analysis was conducted on the key parameters to assess their
uncertainty. The epidemiological data were from US sources. An appropriate benefit measure was used and considered
both expected survival and quality of life, but the derivation of utility values was not clear. The authors reported their
sources, but did not state the instruments used and the populations questioned.

Costs:
The economic analysis was not extensively reported. The costs were presented as category totals, without a breakdown
of items, and the data sources were not described. The patterns of resource consumption were not given. These issues
limit the transparency of the analysis. The authors stated that a societal perspective was adopted, but only the medical
costs appear to have been included. The price year and discounting were clearly presented. Changes in the economic
assumptions were considered in the sensitivity analyses.

Analysis and results:
The results were extensively presented. An incremental approach was appropriately used to synthesise the costs and
benefits of the strategies. A cost-effectiveness frontier was used to illustrate the incremental cost-effectiveness results
and to show the most efficient, as well as the dominated strategies. The analysis of uncertainty considered wide
variations in the model assumptions and was conducted using a deterministic approach. A multivariate analysis would
have been useful, to represent alternative scenarios. The dynamic model was extensively presented in an appendix and
several individual characteristics and compartmental variables were appropriately considered. The results should be
considered to be specific to the authors’ context, as the authors acknowledged. They stated that an important feature of
their analysis was the population-based results.

Concluding remarks:
The methods appear to have been valid and should ensure that the authors’ conclusions are robust, despite the use of
several assumptions.

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