Cost-effectiveness of antiviral drug therapy to reduce mother-to-child HIV transmission in sub-Saharan Africa

Marseille E, Kahn J G, Saba J

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.

Health technology
Antiviral drug therapy to reduce mother-to-child HIV transmission in sub-Saharan Africa.

Type of intervention
Secondary prevention.

Economic study type
Cost-utility analysis.

Study population
The study population consisted of 100 women who entered the HIV testing sequence.

Setting
The setting was a hospital. The economic analysis was carried out in the USA.

Dates to which data relate
Effectiveness and resource use data were collected from studies published between 1989 and 1996. Cost data were taken from sources published between 1988 and 1996. The price year was not reported.

Source of effectiveness data
Effectiveness data were derived from a literature review.

Modelling
A decision tree model was used to determine the cost-effectiveness of the intervention programmes.

Outcomes assessed in the review
The review assessed the seroprevalence of HIV, HIV transmission rates, the percentage of HIV-positive women identified by HIV testing, the percentage of infected women accepting intervention, treatment efficacy, adherence, and disability-adjusted life years (DALYs).

Study designs and other criteria for inclusion in the review
Effectiveness estimates were taken from clinical trials, underway at the time of the study, of shorter course antiviral regimens.
Sources searched to identify primary studies
Not stated.

Criteria used to ensure the validity of primary studies
Not stated.

Methods used to judge relevance and validity, and for extracting data
Summary statistics from individual studies were used.

Number of primary studies included
Eleven primary studies seem to have been included, although it was not always clear from which study a given estimate was derived.

Methods of combining primary studies
Not stated.

Investigation of differences between primary studies
Not stated.

Results of the review
The seroprevalence of HIV among pregnant women was 15%.

The HIV transmission rate in absence of treatment was 35.9%.

The HIV transmission rates were 25.5% up through the peripartum period, and an additional 10.4% through breastfeeding.

The percentage of women identified by HIV testing was 64%.

The percentage of infected women accepting treatment was 75%.

The absolute percentage reduction in transmission was 12.4% (2 - 15) in arm A, 8.6% (2 - 15) in arm B, and 4.3% (2 - 15) in arm C.

The percentage reduction in efficacy to reflect imperfect adherence to regimen was 2.6% in arm A and 0% in arms B and C.

Weights of 0.123 for HIV and 0.505 for AIDS were used to make disability adjustments.

The average life span was 52.5 years.

A disease progression scenario was used in which 25% of HIV-infected children progressed to AIDS by age 12 months, 80% by 60 months, and 100% by 120 months.

Methods used to derive estimates of effectiveness
The authors also made some assumptions, including some to do with adherence to treatment. For regimes B and C they assumed full efficacy. For A, based partly on a study with no reference, they assumed 7.7% had no benefit in the preparation period. For the remainder, they assumed that there was no benefit if less than 4 days of medication were taken and a benefit proportionate to the number of days of medication if 4 days or more were taken.
Estimates of effectiveness and key assumptions
Efficacy for regime A decreased from 12.4% to 9.8% due to lack of adherence. Children were assumed to live for an average of 12 months after progression to AIDS.

Measure of benefits used in the economic analysis
The number of HIV infections averted and the number of DALYs gained were used as the measures of benefit. Benefits were discounted at an annual rate of 5%. DALYs were calculated as the difference between the number of QALYs of HIV-positive children and the expected number of QALYs of HIV-negative children. QALYs were adjusted by age and weight.

Direct costs
Direct costs were discounted at an annual rate of 5%. Quantities and costs were reported separately. Direct costs were the costs of the programme needed to screen pregnant women for HIV infection, women and infant antiviral treatment costs (costs of voluntary counselling and testing (VCT), and drug costs), and the savings in medical care costs for the infants who would have contracted HIV/AIDS had there been no programme. The quantity/cost boundary adopted was that of the health service. VCT costs were derived from a clinic in Zambia. Drug acquisition costs were based on wholesale prices. The price year was not reported.

Statistical analysis of costs
The authors reported costs per 100 women in each intervention arm.

Indirect Costs
Indirect costs were not included.

Currency
US dollars ($).

Sensitivity analysis
One-way and multivariate sensitivity analyses were conducted on efficacy, cost of VCT, drug costs, HIV seroprevalence, and discount rate.

Estimated benefits used in the economic analysis
The number of infections averted compared to no treatment, per 100 women who started the testing sequence were 0.70 in arm A, 0.62 in arm B, and 0.31 in arm C.

The number of DALYs per infection averted was 18.7 for all groups.

The number of DALYs gained compared to no treatment per 100 women who started the testing sequence was 13.2 in arm A, 11.6 in arm B, and 5.8 in arm C.

Cost results
The cost per 100 women who started the testing sequence was $3,617 in arm A, $1,667 in arm B, and $351 in arm C.

Synthesis of costs and benefits
The incremental cost per HIV infection averted over no treatment was $5,134 in arm A, $2,680 in arm B, and $1,129 in
The cost per DALY was $274 in arm A, $143 in arm B, and $60 in arm C.
The incremental cost per HIV infection averted over arm C was $4,230 in arm B.
The incremental cost per DALY over arm C was $226 in arm B.
The incremental cost per HIV infection averted over arm B was $23,643 in arm A.
The incremental cost per DALY over arm B was $1,263 in arm A.

Sensitivity analyses showed that cost-effectiveness declined rapidly at efficacy below 10% or HIV prevalence below 7%. Results were very sensitive to antiviral drug costs. Unfortunately analyses were invalidated due to the use of average cost-effectiveness (all in comparison to no treatment) rather than incremental cost-effectiveness (in comparison to the next most expensive treatment).

**Authors’ conclusions**
Antiviral therapy may be cost-effective compared with other health interventions if HIV prevalence is high, if clinical trials confirm estimated efficacies, and if drug prices are reduced.

**CRD COMMENTARY - Selection of comparators**
A justification was given for the comparator used, namely that "no treatment" represented current practice. You, as a user of this database, should decide if the three intervention regimens are relevant to your own setting.

**Validity of estimate of measure of effectiveness**
The authors undertook a literature review to derive effectiveness estimates, which seemed appropriate, although they did not state that a systematic review of the literature had been undertaken. Effectiveness estimates were derived from clinical trials that had not yet been completed. Hence, estimated efficacies still needed to be confirmed. The validity of the results was enhanced by sensitivity analyses to account for variability and uncertainty in the estimates.

**Validity of estimate of measure of benefit**
Utility weights were taken from a previously published study and adjusted for age and weight, although the authors admit that these weights might not represent the preferences of the local population. Benefits were discounted.

**Validity of estimate of costs**
Good features of the cost analysis were that all relevant direct cost categories were included and the generalisability of the cost results was enhanced by appropriate sensitivity analyses. Quantities and costs were reported separately. However, the price year was not reported which would make reflation exercises in other settings problematic. Cost estimates were taken from particular countries and may not be generalisable to other countries in sub-Saharan Africa.

**Other issues**
The authors made appropriate comparisons of their findings with those from other studies and addressed the issue of generalisability to other settings, both through sensitivity analysis, and in the discussion. The authors did not present their results selectively. The study considered women entering the HIV testing sequence and this was reflected in the authors' conclusions. The analysis assumed constant marginal programme costs. However, in reality, marginal costs often rise as coverage increases. According to the authors, this implies that the cost per case averted in some locations using arm C may exceed those in arm B, especially as arm C reaches a substantial proportion of its target population.
Implications of the study
The authors stated that antiviral therapy may be cost-effective compared with other health interventions if HIV prevalence is high, if clinical trials confirm estimated efficacies, and if drug prices were to be reduced. However, the authors themselves cite examples of public health interventions in sub-Saharan Africa that are more cost-effective. These range from $13/DALY for improved detection and treatment of sexually transmitted diseases in adults to $300/DALY for onchocerciasis vector control to prevent river blindness.

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