Modeling the impact of HIV chemoprophylaxis strategies among men who have sex with men in the United States: HIV infections prevented and cost-effectiveness


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
The objective was to examine the cost-effectiveness of a human immunodeficiency virus (HIV) chemoprophylaxis programme in very high-risk men who have sex with men. The authors concluded that HIV chemoprophylaxis reduced the number of HIV infections and was cost-effective. The data sources were only partially reported, but the study was based on a valid analytic approach, which should have ensured that the conclusions were generalisable and robust.

Type of economic evaluation
Cost-utility analysis

Study objective
The objective was to examine the cost-effectiveness of a human immunodeficiency virus (HIV) chemoprophylaxis programme in very high-risk men who have sex with men (MSM), compared with the usual HIV prevention practices.

Interventions
The intervention was a five-year drug-based HIV prevention programme, which consisted of a once-daily, self-administered oral chemoprophylaxis regimen for high-risk HIV-negative MSM. The chemoprophylaxis regimen was either tenofovir disoproxil fumarate (a nucleoside reverse transcriptase inhibitor) or a combination tablet of emtricitabine (a nucleotide reverse transcriptase inhibitor) and tenofovir disoproxil fumarate. This programme was compared with no chemoprophylaxis.

Various scenarios with different combinations of mechanism of protection, efficacy, adherence, and population coverage were considered.

Location/setting
USA/primary care.

Methods
Analytical approach:
The analysis was based on a stochastic compartmental mathematical model, which provided a dynamic representation of HIV transmission. The programme was implemented for five years and the model had a lifetime horizon. The authors stated that the perspective was that of the health care system.

Effectiveness data:
The clinical evidence came from published literature, and information on the characteristics of these primary sources of data was provided in an online appendix. The treatment effect was from randomised controlled trials, but no details of these sources were given. These data were validated using actual estimates from the Centers for Disease Control and Prevention and the New York City Department of Health and Mental Hygiene. The key clinical input was the rate of HIV transmission.

Monetary benefit and utility valuations:
The utility values were derived from the literature, the details of which were not reported.
Measure of benefit:
Quality-adjusted life-years (QALYs) were the summary benefit measure and were discounted at an annual rate of 3%.

Cost data:
The economic analysis included the costs of chemoprophylaxis administration and monitoring, the cost of the programme implementation, such as venues and special publications, and the savings associated with prevented HIV treatment. In general, the economic data were derived from published sources. The drug costs were based on average wholesale prices and other costs were derived from Medicare reimbursement rates. Some assumptions were also made. All costs were in US dollars ($) and were discounted at an annual rate of 3%. The drug costs were at 2007 rates, but the price year was not explicitly reported.

Analysis of uncertainty:
All the model inputs were varied in a multivariate sensitivity analysis, using published ranges of values, for all scenarios. The incremental cost-utility ratios were calculated for chemoprophylaxis threshold prices for all combinations of programme parameters and three estimates of lifetime treatment costs, as well as for the expected number of cases prevented. The combined effects of chemoprophylaxis efficacy and increase in risk behaviour on the number of cases of HIV prevented were also assessed using arbitrary ranges of values.

Results
In the base case (coverage of 15,000 high-risk MSM, the basic mechanism of protection, an efficacy of 50%, programme adherence of 50%, and a daily dose cost of $31), the chemoprophylaxis programme led to $354 million net cost and saved 11,000 QALYs in comparison with no intervention. The incremental cost per QALY gained was $31,970.

The daily cost of the drug had to be over $39 before the $50,000 willingness-to-pay threshold was exceeded. The QALYs gained arose from reduced infections; more than half of these reduced infections were among those not taking chemoprophylaxis, but who benefited from reduced HIV prevalence in the community.

The key finding of the sensitivity analysis was that the incremental cost-utility ratio fell below the $50,000 threshold in 75% of 80 scenarios and below the $100,000 threshold in 87.5% of scenarios. Higher cost-utility ratios were generally associated with lower adherence.

Authors’ conclusions
The authors concluded that the HIV chemoprophylaxis programme reduced the number of HIV infections and was cost-effective.

CRD commentary
Interventions:
The selection of no chemoprophylaxis as the background comparator was appropriate as it represented the current pattern of care in the authors’ setting.

Effectiveness/benefits:
Very few details of the clinical data were provided, but more information was available in an online appendix. It appears that the treatment effect for chemoprophylaxis was derived from randomised controlled trials which, in general, are a valid source for clinical data. Neither the design nor the patient characteristics were provided for the sources for the model parameters, which means it is not possible to judge their suitability. The authors considered several different scenarios and the clinical inputs were varied in an extensive sensitivity analysis. QALYs were appropriate as the benefit measure as they capture the impact of the intervention on patients’ health. They can also be compared with the benefits of other health care interventions.

Costs:
The categories of costs appear to have been appropriate for the perspective, but few details on the resource use and costs were provided, with only a limited description of the sources used. More information should be available in the online appendix. Other details of the analysis, such as the price year and the use of discounting, were reported. The
variability in the costs was investigated in the sensitivity analysis.

Analysis and results:
The costs and benefits were appropriately synthesised using an incremental approach. The expected cost-utility ratios were presented for a variety of scenarios, which enhances the external validity of the analysis. The issue of uncertainty was satisfactorily addressed and the findings were clearly presented and discussed. The use of a dynamic model was a strength of the analysis.

Concluding remarks:
The data sources were only partially reported, but the study was based on a valid analytical approach, which should have ensured that the authors’ conclusions were generalisable and robust.

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