Cost-effectiveness of HIV screening for incarcerated pregnant women

Resch S, Altice F L, Paltiel A D

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
Six alternative human immunodeficiency virus (HIV) screening strategies for incarcerated pregnant women were investigated. The strategies were:

- no screening;
- mandatory newborn screening (MNS) alone;
- voluntary prenatal screening (VPS) alone;
- VPS with MNS;
- routine prenatal screening (RPS); and
- RPS with MNS.

Type of intervention
Screening.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised pregnant incarcerated women of unknown HIV status.

Setting
The study setting was community. The economic study was carried out in the USA.

Dates to which data relate
The effectiveness data were derived from studies published between 1991 and 2001, and a large and comprehensive anonymously linked serosurvey of all inmates who entered correctional facilities for women from November 1994 to October 1996 (York Correctional Institution data). The price year was not reported.

Source of effectiveness data
The effectiveness data were mainly derived from a large and comprehensive anonymously linked serosurvey of all inmates who entered Connecticut's sole correctional facilities for women (York Correctional Institution data). Other sources of effectiveness data were published studies and authors' assumptions.
Modelling
A decision tree was used to predict the impact of six alternative HIV screening strategies for incarcerated pregnant women. Women who accepted testing and who were identified as HIV infected were offered highly active antiretroviral therapy (ART). Newborns that were identified as HIV infected were to receive zidovudine monotherapy. The cost-effectiveness analysis was carried out on the basis of two separate assumptions: the decision-maker can choose any of the six strategies evaluated, or the decision maker cannot choose strategies that included MNS.

Outcomes assessed in the review
The outcomes assessed in the review were:

- the overall probability of being HIV positive given that the woman was pregnant and did not self-report as being infected with HIV;
- the probability that the woman accepts either voluntary or routine HIV testing;
- the relative risk of declining routine or voluntary testing for HIV versus uninfected women;
- the probability of being HIV positive given that the woman accepted voluntary or routine HIV testing;
- the probability of being HIV positive given that the woman declined voluntary or routine HIV testing;
- the probability of mother-to-child transmission with no ART;
- the probability of mother-to-child transmission with ART initiated in the newborn;
- the probability of mother-to-child transmission with therapy initiated prenatally; and
- the additional risk of perinatal transmission attributable to breast feeding.

Study designs and other criteria for inclusion in the review
The effectiveness data were mainly derived from a large prospective cohort study (York Correctional Institution data).

Sources searched to identify primary studies
Not reported.

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

Methods used to judge relevance and validity, and for extracting data
Not reported.

Number of primary studies included
Approximately five primary studies were included in the review.

Methods of combining primary studies
Some effectiveness parameters derived from the primary studies were combined using a narrative method.

Investigation of differences between primary studies
Potential differences between the primary studies were not discussed in the analysis.

**Results of the review**
The overall probability of being HIV positive given that the woman was pregnant and did not self-report as being infected with HIV was 0.99%.

The probability that the woman accepted voluntary HIV testing was 63.8%.

The probability that the woman accepted routine HIV testing was 95.0%.

The relative risk of declining routine testing for HIV versus uninfected women was 1.0.

The relative risk of declining voluntary testing for HIV versus uninfected women was 1.0.

The probability of being HIV positive given that the woman accepted voluntary HIV testing was 0.99%.

The probability of being HIV positive given that the woman accepted routine HIV testing was 0.99%.

The probability of being HIV positive given that the woman declined voluntary HIV testing was 0.99%.

The probability of being HIV positive given that the woman declined routine HIV testing was 0.99%.

The probability of mother-to-child transmission with no ART was 25.5%.

The probability of mother-to-child transmission with ART initiated in the newborn was 11.0%.

The probability of mother-to-child transmission with therapy initiated prenatally was 1.6%.

The additional risk of perinatal transmission attributable to breast feeding was 14%.

**Methods used to derive estimates of effectiveness**
The authors supplemented the estimates of effectiveness with their own assumptions, which were based on reports from the literature.

**Estimates of effectiveness and key assumptions**
The authors made the following assumptions about probabilities:

- the probability of breast feeding among women who knew they were HIV infected was 0%;
- the probability of breast feeding among women who did not know their HIV status was 0%;
- the probability of accepting ART during pregnancy was 100%; and
- the probability of adherence to post birth ART for at-risk newborns was 100%.

The authors made the following assumptions about HIV test characteristics:

- the sensitivity and specificity of the enzyme-linked immunosorbent assay was 100%; and
- the sensitivity and specificity of Western blot was 100%.

**Measure of benefits used in the economic analysis**
The measure of benefits used was the number of paediatric HIV infections averted.
Direct costs
The direct costs included were those of the state government. These comprised the costs of administering the alternative testing strategies and the lifetime costs of medical care for HIV-infected newborns and their mothers. Such costs covered testing, ART, the lifetime medical costs associated with paediatric HIV infection, and the costs of early maternal ART. The costs of testing covered the costs of the tests themselves and the costs of counselling, both before and after the test if the woman was found to be HIV positive. The cost of ART covered the costs of perinatal combination therapy and post-birth zidovudine therapy. The costs were derived from the literature and were supplemented by the authors' assumptions. The cost of therapy was estimated using average wholesale prices. As some costs could be incurred over an entire lifetime (i.e. lifetime medical costs), discounting was necessary. Thus, future costs were appropriately discounted at a rate of 3%. The average costs were reported in the study. The price year was not reported.

Statistical analysis of costs
The costs were treated as point estimates (i.e. the data were deterministic).

Indirect Costs
The indirect costs were not included in the analysis.

Currency
US dollars ($).

Sensitivity analysis
To explore the impact of uncertainty in the underlying data, sensitivity analyses were performed on several model parameters;

- maternal acceptance of therapy for herself;
- the breast feeding rate among women with unknown HIV status;
- the acceptance of voluntary testing;
- the probability of accepting the testing route;
- the relative risk of declining HIV testing for HIV infected versus uninfected women;
- the probability of mother-to-child transmission for newborn initiated therapy;
- the lifetime costs of paediatric HIV infection;
- the early detection of maternal disease; and
- the cost of early maternal therapy.

Estimated benefits used in the economic analysis
The probability of paediatric HIV infection, per HIV status-unknown pregnant entrant, was:

- for no screening, 0.25%;
- for MNS, 0.11%;
for VPS and MNS, 0.05%;
for RPS and MNS, 0.02%;
for RPS alone, 0.03%; and
for VPS alone, 0.10%.

Cost results
The cost per woman for each of the screening strategies was:

- for no screening, $624;
- for MNS, $364;
- for VPS and MNS, $423;
- for RPS and MNS, $430;
- for RPS alone, $443; and
- for VPS alone, $517.

Synthesis of costs and benefits
To compare the different strategies, the costs and benefits were combined using an incremental cost-effectiveness ratio (i.e. the additional costs required per HIV infection prevented). The authors found that no screening was strongly dominated by MNS, as it was both more expensive and less effective. When VPS plus MNS was compared with MNS alone, VPS plus MNS was found to be extended dominated. When RPS plus MNS was compared with MNS alone, the incremental cost-effectiveness ratio was $73,603 per HIV infection prevented. Both RPS alone and VPS alone strategies were found to be strongly dominated by RPS and MNS.

The authors re-calculated the incremental cost-effectiveness analysis by only considering prenatal screening strategies. Compared with no screening, RPS alone was found to be dominant as it was both less costly and more effective. When VPS was compared with RPS alone, VPS was strongly dominated (i.e. both more costly and less effective).

The results from the sensitivity analysis showed that, in general:

- dominated strategies remained dominated;
- cost-saving strategies remained cost-saving; and
- the incremental cost-effectiveness ratios remained in the range of $86,000 to $220,000 per additional paediatric infection prevented.

Authors’ conclusions
Among pregnant female prisoners, mandatory newborn screening (MNS) alone was a cost-saving programme. Routine prenatal screening (RPS) combined with MNS was associated with an incremental cost-effectiveness ratio of $73,603 per additional paediatric human immunodeficiency virus (HIV) infection averted when compared with MNS.

CRD COMMENTARY - Selection of comparators
The authors compared all the possible HIV screening strategies for incarcerated pregnant women in their settings. You should decide if these represent current practice in your own setting.
Validity of estimate of measure of effectiveness
The authors used data from a large prospective cohort study, supplementing the evidence from this study with estimates from published studies and assumptions based on current literature. However, the authors did not report whether a systematic review of the literature had been undertaken to identify all relevant research and minimise biases. The authors provided details on the study population and study sample in the cohort study, and also details from studies providing supplementary evidence of effectiveness. Further, all assumptions were examined in the sensitivity analysis.

Validity of estimate of measure of benefit
The estimation of benefits was modelled appropriately using a decision analytic tree. As the authors compared incremental cost-effectiveness ratios from their study with those of other interventions, which reported outcomes in life-years gained, it would have been desirable if the health outcomes could have been reported in either life-years gained or quality-adjusted life-years gained. This would have increased comparability across interventions.

Validity of estimate of costs
All the categories of cost relevant to the perspective adopted were included in the analysis. No major costs appear to have been omitted from the analysis. The costs and the quantities were not reported separately, which will limit the generalisability of the authors’ results. The costs were derived from published sources. The authors described in great detail where the costs were derived from and any assumptions they made. Appropriate sensitivity analyses of the costs were performed, although these could have been more thorough and included more cost components. The lifetime medical costs were appropriately discounted. The price year was not reported, which will hamper any possible inflation exercises.

Other issues
The authors did not compare their findings with those from similar studies. The issue of generalisability to other settings was not addressed. The authors do not appear to have presented their results selectively, and their conclusions reflected the scope of the analysis.

The authors reported a number of further limitations to their study. First, the impact of the screening programmes was underestimated, as a woman re-entering prison could have known her HIV status through prior screening in prison and this was not accounted for in the analysis. Second, HIV-infected women may not have such high acceptance rates as the overall population. Third, the potential benefit to the mother of early HIV detection was not considered since the measure of benefit was paediatric HIV cases averted. Fourth, the model did not consider the benefits of early detection of HIV in terms of lower infectivity because of an earlier diagnosis of HIV. Finally, the long-term survival of paediatric HIV patients treated with combination therapy was still uncertain.

Implications of the study
The authors reported that as correctional facilities adopt screening strategies for HIV screening that do not require pre-test counselling, it is important that they adopt new and cost-effective approaches to identifying HIV among pregnant women and reducing transmission to their children.

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Bibliographic details
Other publications of related interest


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