The cost-effectiveness of the cytology laboratory and new cytology technologies in cervical cancer prevention

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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.

Health technology
The use of cervicovaginal screening, compared with a 'no smear' strategy, for the prevention of cervical cancer.

Type of intervention
Prevention and screening.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised women. No further details about the study population were reported.

Setting
The setting was secondary care. The economic study was carried out in the University of Iowa Hospitals and Clinics, in Iowa City, USA.

Dates to which data relate
The probability and outcome data were taken from literature published between 1960 and 1997. The price year was 1997.

Source of effectiveness data
The effectiveness data were taken from a synthesis and review of the published literature.

Modelling
A decision-analytic model was used to derive the outcomes from the existing patient probabilities for risk of disease.

Outcomes assessed in the review
The outcomes used as input parameters in the model were:

- the probability of the progression of high-grade squamous intraepithelial lesion (SIL) to cancer;
- the probability of the progression of high-grade SIL to cancer in 1 year;
- the probabilities of local, regional, distant and unstaged carcinoma;
the probability of developing high-grade SIL given a smear diagnosis for high-grade SIL, low-grade SIL, dysplasia, or atypia; and

the life expectancies at the no cancer, local, regional, distant, and unstaged stages of disease.

Study designs and other criteria for inclusion in the review
Not reported.

Sources searched to identify primary studies
MEDLINE was searched for primary data sources.

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 7 primary studies were included in the review.

Methods of combining primary studies
Not reported.

Investigation of differences between primary studies
Not reported.

Results of the review
The results for the outcomes used as input parameters in the model were as follows.

The probability of progression of high-grade SIL to cancer was 10%.

The probability of progression of high-grade SIL to cancer in 1 year was 25%.

The probabilities of the various carcinoma stages were 51% for local, 33% for regional, 8% for distant, and 7% for unstaged.

The probability of developing high-grade SIL was 100% given a smear diagnosis for high-grade SIL, 20% with a diagnosis of low-grade SIL, 5% with a diagnosis of dysplasia, and 10% with a diagnosis of atypia.

The life expectancies for the various disease stages were 50.7 years for no cancer, 46.3 years for local, 26.6 years for regional, 6.6 years for distant, and 32.0 years for unstaged.

Measure of benefits used in the economic analysis
The benefit measure used was the number of discounted life-years gained per patient.

Direct costs
The quantities and costs were not reported separately. The perspective from which the study was conducted was unclear. The costs were reported for the interpretation of the smear, the treatment, and the procedures.

The costs associated with the interpretation of a cervicovaginal smear were divided into laboratory costs ($0.89 per case), personnel benign cases ($4.18 per case), personnel atypical cases ($2.97 per case), and overheads ($7.11 per case).

The treatment costs were subdivided according to the stage of the disease, and were reported at 6-month intervals.

Local cancer: the initial cost was $8,500, the continuing cost was $3,000, the pre-final cost was $7,200, and the terminal cost was $10,600.

Regional cancer: the initial cost was $10,000, the continuing cost was $3,300, the pre-final cost was $7,700, and the terminal cost was $11,700.

Distant cancer: the initial cost was $1,200, the continuing cost was $4,700, the pre-final cost was $9,900, and the terminal cost was $11,900;

Unstaged cancer: the initial cost was $7,200, the continuing cost was $3,900, the pre-final cost was $8,100, and the terminal cost was $9,800.

The procedural costs were subdivided according to the service used.

Colposcopy: the cost of gynaecology was $250, the cost of pathology was $0, and the total cost was $250.

Colposcopy with biopsy: the cost of gynaecology was $383, the cost of pathology was $94, and the total cost was $477.

Loop electrosurgical excision procedure: the cost of gynaecology was $855, the cost of pathology was $374, and the total cost was $1,229.

Routine examination: the cost of gynaecology was $50, the cost of pathology was $0, and the total cost was $50.

The authors reported that the cost data were obtained from the University of Iowa Hospitals and Clinics, and the medical literature. The timeframe of the study was not reported. The costs were not discounted. The price year was 1997.

**Statistical analysis of costs**

No statistical analysis of costs was conducted.

**Indirect Costs**

No indirect costs were included in the analysis.

**Currency**

US dollars ($). No currency conversions were reported.

**Sensitivity analysis**

One-way sensitivity analyses were performed to study the effect of decision-model variables on the cost-effectiveness of cervicovaginal screening. The variables changed were the cost to the cytology laboratory of cervicovaginal screening and the SIL rate. To assess the effect of new cytology technologies on cost-effectiveness, the authors assumed that the new technologies had higher detection rates and costs than the conventional methods.
Estimated benefits used in the economic analysis
The discounted life expectancy of those patients who did not undergo a cervicovaginal smear test was 18.5978 years.

The discounted life expectancy of those patients who underwent a cervicovaginal smear test was 18.6032 years.

Cost results
The cost of having a cervicovaginal smear alone was $15.15 per patient.

The total cost in the 'no smear' group was $108.70 per patient.

The total cost of receiving a smear test and treatment was $214.84 per patient.

Synthesis of costs and benefits
The cost of performing a cervicovaginal smear, compared with not performing a smear, in order to gain a year of discounted life expectancy was $2,805.

The cost of a cervicovaginal smear and treatment for SIL, compared with no smear, in order to gain a discounted year of life expectancy was $19,655.

The authors reported the sensitivity analyses graphically. They explained that as the cost of the cervicovaginal smear increased from $10 to $75, the cervicovaginal smear became less cost-effective at the same laboratory atypical rate (32.756).

The authors also explored the impact of using three cost-effectiveness cut-off values ($50,000, $100,000 and $200,000). At a cost-effectiveness cut-off value of $50,000 per discounted life-year gained, cervicovaginal screening was cost-effective regardless of the cost of the smear, unless the atypical rate of the laboratory was low. The authors reported that for high-risk populations (a population with a high atypical rate), cervicovaginal screening would be cost-effective even if the cost of the smear was high.

The authors also considered the cost-effectiveness of using new laboratory technology. If the technology cost was $10 then, assuming a cost-effectiveness cut-off value of $50,000 per discounted life-year gained, an additional 236 high-grade SILs would have to be detected per 10,000 women for that technology to be cost-effective. If the number of high-grade SILs was lower then the technology would not be cost-effective. If the cost-effective cut-off value increased and the cost of the technology remained the same, that technology would become cost-effective at a lower increased HSIL detection rate.

Authors' conclusions
The laboratory component alone, and the entire cervicovaginal screening strategy, was cost-effective when compared with the 'no smear' strategy.

CRD COMMENTARY - Selection of comparators
The comparator, (no cervicovaginal smear) was justified on the grounds that it represented a reference case. You should decide if this is a widely used alternative to cervicovaginal smears in your own setting. The authors also made some reference to different methods, such as automated screening devices and monolayer preparation machines, for analysing cervicovaginal smears. However, they did not explicitly evaluate the costs and benefits of these approaches.

Validity of estimate of measure of effectiveness
The authors did not report that a systematic review of the literature had been undertaken. No information was provided on the methods used to select and assess the primary studies, or to extract the data. The authors used data from the available studies selectively, but did not consider the impact of differences between the primary studies when estimating the effectiveness.
Validity of estimate of measure of benefit
The estimation of benefits was modelled. The instrument used to derive a measure of health benefit, a decision-analytical model, was appropriate.

Validity of estimate of costs
The perspective from which the study was conducted was not reported. This it was not possible to determine if all the relevant costs had been included in the analysis. No statistical analysis of the costs or quantities was performed. The authors did, however, undertake a sensitivity analysis of the quantities and costs using appropriate ranges. The currency specified was not converted, and the costs were not discounted. However, the life expectancies of the patients were discounted at a rate of 5%.

Other issues
The authors made appropriate comparisons of their findings with those from other studies, but did not fully address the issue of generalisability to other settings. The authors appear to have presented their results selectively. The authors reported a limitation to their study in that the decision-analytical model used was not prospective. They went on to state that prospective studies are needed in order to confirm high-grade and low-grade SIL detection rates in different populations of patients.

Implications of the study
The authors concluded that the laboratory component alone, and the entire cervicovaginal screening strategy, was cost-effective when compared with the 'no smear' strategy. In addition, cancer screening was cost-effective in moderate- to high-risk women, even at high cytology laboratory costs. However, the authors also stated that the new technologies were only cost-effective if they resulted in a substantial increase in the detection of high-grade SIL. So far, the new technologies have yet to demonstrate these increased detection rates. Consequently, the authors propose that new studies should be performed to confirm the increased detection rates for high-grade and low-grade SIL.

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