Cost-effectiveness of dilation and evacuation versus the induction of labor for second-trimester pregnancy termination

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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 aim of this study was to compare the cost-effectiveness of dilation and evacuation (D&E) versus misoprostol induction of labour (IOL) for second-trimester termination. Vaginal misoprostol, 200 microg administered every 12 hours, was used for IOL.

Type of intervention
Treatment.

Economic study type
Cost-utility analysis.

Study population
The target population was a 30-year-old woman who desires pregnancy termination between 13 and 24 weeks’ gestation of a well-dated pregnancy.

Setting
The setting was tertiary care. The economic study was carried out in Chicago, IL, USA.

Dates to which data relate
The effectiveness evidence was taken from 1982 to 2003. Health service resource use and costs were taken from 2000 to 2003. The price year was 2003.

Source of effectiveness data
The effectiveness data were derived from completed studies.

Modelling
A decision analytic model was developed, based on a decision tree, to compare both strategies. Base-case values and their ranges were determined for each parameter in the model. The time horizon of the model was unclear, but it appears to have been the patient's lifetime.

Outcomes assessed in the review
In the D&E arm, the outcomes included uncomplicated procedure, complications and death at the time of the procedure. Possible complications were cervical laceration, retained products of conception, infection, uterine perforation, or haemorrhage. These necessitate, respectively, cervical repair, suction-curettage, inpatient medical treatment, or laparotomy with or without hysterectomy.
In the IOL arm, the outcomes included uncomplicated delivery, complications, or death during labour induction. Possible complications were those already noted in the D&E arm, plus failed induction (defined as failure to deliver the foetus within 48 hours of treatment).

**Study designs and other criteria for inclusion in the review**
No inclusion or exclusion criteria for a review of any of the parameters were reported. The studies used were primary studies of varying design, such as observational studies, randomised controlled trials and cohort studies.

**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**
The authors reported the use of 25 primary studies as sources of effectiveness evidence.

**Methods of combining primary studies**
A narrative method was used to combine the primary studies.

**Investigation of differences between primary studies**
No differences between the primary studies were investigated.

**Results of the review**
For the base-case, the probabilities in the D&E and IOL arms were, respectively:

- 2.2% and 1.6% for cervical repair,
- 0.4% and 20% for suction curettage,
- 1.3% and 0.8% for inpatient medical treatment,
- 0.1% and 1.6% for laparotomy,
- 0.013% and 0.02% for hysterectomy, and
- 0.004% and 0.01% for maternal death.

In the IOL arm, the additional complication of failed induction had a probability of 5.6%.

The base-case values were reported with the corresponding range values and the source reference.

**Methods used to derive estimates of effectiveness**
The study was based on published data and authors’ assumptions.
Estimates of effectiveness and key assumptions
In the model, assumptions were made that each possible complication was mutually exclusive and that the rate of complications were the same for all procedures between 13 and 24 weeks' gestation. Rare outcomes, such as the performance of uterine artery embolisation for intractable haemorrhage, were not included.

Measure of benefits used in the economic analysis
The measure of benefit was the quality-adjusted life-years (QALYs). A utility score of 1.0 was assigned to all uncomplicated outcomes, as well as outcomes that involved transient complications but did not result in hysterectomy or death, given that their very short-term nature made them unlikely to affect future quality of life or substantively impact lifetime QALYs. Hysterectomy after either procedure received a utility score of 0.88, which was the published utility score of second trimester pregnancy termination without a future birth. Decrements in QALYs were incorporated for all possible outcomes with a range of utility scores, and were generally applied for 6 months after the complication occurred. The only exception was the range of utility scores that was used for the complication of hysterectomy, which was applied for the entirety of the patients’ survival. Discounting was carried out at a rate of 3%.

Direct costs
Direct cost categories for each procedure included the cost of facility use, the cost of professional services and the cost of supplies. Supplies referred to non-reusable items required for patient care (e.g. intravenous fluids and medications). The cost items were listed in an appendix. Charges for each procedure were compiled from billing data from the authors’ institution and a cost-to-charge ratio was used. The cost of maternal death could not be determined with this method because of the variety of circumstances that might lead to this outcome. The authors therefore performed a sensitivity analysis on this category for both D&E and IOL procedures. A discount rate of 3% was applied. The quantities and the costs were not analysed separately. The quantities and cost estimations were derived through modelling. The price year was 2003.

Statistical analysis of costs
No statistical analysis of the costs was reported.

Indirect Costs
The indirect costs were not included.

Currency
US dollars ($).

Sensitivity analysis
A univariate sensitivity analysis was performed to assess changes in probability, utility score and cost parameters. The probabilities were varied according to estimates from the literature. The costs were varied +/- 50% of the baseline. A Monte Carlo simulation was also performed, using 1,000 trials to test the robustness of the model to variability in the parameters. A strategy was considered to be cost-effective at a ratio of less than $50,000/QALY.

Estimated benefits used in the economic analysis
The QALYs were 25.6981 for D&E and 25.6964 for IOL.

Cost results
From the hospital perspective, the total resource costs were $3,530 for D&E and $6,608 for IOL.
Synthesis of costs and benefits

The results of the model using baseline estimates showed that surgical termination was both less expensive and more effective than medical termination. Thus, D&E was the dominant strategy.

Varying the baseline patient age from 15 to 45 years did not change the results.

In the one-way sensitivity analysis, D&E was generally the dominant strategy across all probability, utility score and cost ranges. There were three exceptions. One, when the probability of hysterectomy as the result of D&E rose from the baseline value of 0.013 to 0.04%. Two, when the probability of dying from IOL was decreased to zero. Finally, when the utility score for laparotomy without hysterectomy was decreased to 0.96. In all three cases IOL had a high marginal cost-effectiveness ratio of $29.9 million, $3.4 million, and $8.6 million per additional QALY, respectively.

In the Monte Carlo simulation using 1,000 trials and a threshold of $50,000/QALY, the IOL was found to be acceptable in only 2.1% of trials. D&E was the preferred approach in the remaining 97.9% of trials. Using a threshold of $75,000/QALY, IOL was acceptable in only 2.4% of trials.

Authors’ conclusions

In this model, dilation and evacuation (D&E) was both less expensive and more effective than misoprostol induction of labour (IOL) for second-trimester termination. This result was robust on sensitivity analysis.

CRD COMMENTARY - Selection of comparators

The authors justified their choice of the comparators used. The two procedures had not been compared in a prospective, randomised trial; the cost-effectiveness of each had not been evaluated; and it remains controversial whether surgical or medical termination is the best option in this group. You should judge whether these strategies are relevant in your own setting, or whether other comparators could also be relevant.

Validity of estimate of measure of effectiveness

The authors did not state that a systematic review of the literature had been undertaken. Although this is a common practice with models, it does not always ensure that the best data available are used in the model and that all relevant literature is identified. The effectiveness evidence was mostly derived from randomised clinical trials, which are an adequate source for estimating effectiveness. The authors used data from the available studies selectively. The estimates of effectiveness were derived credibly from the studies identified. The authors used data from published sources and their own assumptions, which were justified by reference to the medical literature. The estimates were investigated by sensitivity analyses using ranges from the literature. The authors provided a justification for the ranges selecte

Validity of estimate of measure of benefit

The authors used QALYs as a measure of benefits. These were derived from a decision analysis model. This measure of benefit enables cross health technology comparisons. The methods to derive utility scores were based on published literature. Sensitivity analyses on utility estimates were conducted.

Validity of estimate of costs

The authors reported that the costs were estimated from a hospital perspective. Therefore, the indirect costs were appropriately not included. Although some costs could have been omitted from the analysis, these were unlikely to have affected the authors’ conclusions since they were common to both procedures. The resource use quantities and prices were not reported separately, which would make it difficult to replicate the calculations or to gauge the accuracy of the estimation of quantities. Charges were used as a proxy for costs and this carries with it the limitation of not reflecting true opportunity costs, thus restricting the external validity of the results. However, a charge-to-cost ratio was used to derive cost values, and this may enhance the generalisability of the results beyond the authors’ clinical setting. The costs were treated deterministically. However, sensitivity analyses were performed on the cost data to assess the robustness of the estimates used. Discounting was appropriately carried out given that the time horizon was more than 2 years. The
date to which the prices referred was recorded, which aids the replication of the results.

**Other issues**
The authors did not make appropriate comparisons of their findings with those from other studies. They did not explicitly address the generalisability of the results, although they considered that patient preference plays an important role in settings in which both procedures are available and that it remains controversial which procedure is the best option. The authors’ conclusions reflected the scope of the analysis. The authors stated that the study was subject to certain limitations. For example, complications were mutually exclusive and similar between 13 and 24 weeks’ gestation. Other limitations were the exclusion of rare outcomes, the inherent limitations of the study sources, the derivation of costs through modelling institutional charges, and the exclusion of cost of training providers or consequences of skill heterogeneity to perform D&E. Nevertheless, given the robustness of the model in the sensitivity analysis, the authors did not believe that these limitations had affected their conclusions substantively.

**Implications of the study**
The practice of D&E is severely limited by a lack of trained providers. Although IOL is widely available and might be more easily incorporated into medical education, physician practice and patient care provision, accessibility of D&E should be made a priority. Factors to consider are the option of D&E training for medical students and residents, referral possibilities from physicians, and a further evaluation of the economic and patient care benefits from hospital administrators and third-party payers.

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