Screening for gestational diabetes mellitus: a decision and cost-effectiveness analysis of four screening strategies
Nicholson W K, Fleisher L A, Fox H E, Powe N R

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
Three screening strategies for the detection of gestational diabetes mellitus (GDM) were examined:

the sequential strategy, which consisted of an initial 50-g glucose challenge test followed, in those who test positive, by a 100-g glucose tolerance test (GTT);

the 75-g GTT strategy; and

the 100-g GTT strategy.

Type of intervention
Screening.

Economic study type
Cost-utility analysis.

Study population
The study population comprised a hypothetical cohort of pregnant women of between 24 and 28 weeks' gestation.

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

Dates to which data relate
The effectiveness data were derived from studies published between 1964 and 2003. No dates for resource use were reported. The costs were derived from 2003 sources. The price year was 2003.

Source of effectiveness data
The effectiveness evidence was derived from a synthesis of completed studies.

Modelling
A decision model was constructed to assess the impact of the alternative screening strategies on patient health and costs in a hypothetical cohort of 30-year-old pregnant women between 24 and 30 weeks' gestation. Separate models were considered for mothers and infants. Maternal outcomes were hypertensive disease, polyhydramnios, Caesarean or vaginal delivery, and the potential complications of Caesarean and vaginal delivery. Complications included operative injury, endometritis, deep vein thrombosis, severe haemorrhage requiring blood transfusion, and hysterectomy. Neonatal outcomes were mild hypoglycaemia (≤ 50 g/dL requiring intravenous fluid and observation), macrosomia...
(birth weight more than 4,500 g), respiratory distress syndrome, shoulder dystocia, none or mild morbidity, moderate morbidity, and severe morbidity or infant death. The model incorporated three maternal health states, that is, perfect health, perfect health following hysterectomy, and maternal death. The three neonatal health states were none or mild morbidity, moderate morbidity, and severe morbidity or neonatal death.

Outcomes assessed in the review
The outcomes estimated from the literature were test accuracy (sensitivity and specificity values), utility values associated with health states, and life expectancy.

Study designs and other criteria for inclusion in the review
It was unclear whether a systematic review of the literature was undertaken to identify the primary studies. Life expectancy was estimated from US life tables. Details of the other sources of data were not reported.

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
Not reported.

Number of primary studies included
Seven primary studies provided the evidence.

Methods of combining primary studies
Not stated.

Investigation of differences between primary studies
Not reported.

Results of the review
The sensitivity was 80% and the specificity was 86% when using a standard cut-off value of 140 mg/dL for the 50-g glucose challenge test and the World Health Organization 2-hour threshold value (>/= 140 mg/dL) for the 75-g GTT.

The sensitivity of the 75-g GTT was 80% and the specificity 86%.

The sensitivity and specificity values were both 100% for the 100-g GTT (fasting < 95 mg/dL, 1 hour 180 mg/dL, 2 hour 155 mg/dL, 3 hour 145 mg/dL).

The utility values for the maternal health states were 1.0 (perfect health), 0.9 (perfect health following hysterectomy) and 0 (maternal death).

The utility values for the neonatal health states were 1.0 (none or mild morbidity), 0.7 (moderate morbidity) and 0 (severe morbidity or neonatal death).
Measure of benefits used in the economic analysis
The summary benefit measure used was the expected number of quality-adjusted life-years (QALYs). These were estimated by combining survival data and utility weights obtained from the literature. Details of the source of the utility data were not reported. An annual discount rate of 3% was applied.

Direct costs
The analysis of the costs was carried out from a societal perspective. Physician and hospital costs were included in the analysis of direct costs. A detailed breakdown of the cost items was not reported. The unit costs were not presented separately from the quantities of resources used. The costs were estimated using the 2003 Medicare resource-based relative value units and the 1997-2001 Maryland Health Care Commission Database. Hospital charges were converted to costs using cost-to-charge ratios. The source of the resource use data was unclear. Discounting was relevant and an annual rate of 3% was appropriately applied. All the costs were adjusted to 2003 values using the annual medical care component of the Consumer Price Index.

Statistical analysis of costs
The costs were treated deterministically.

Indirect Costs
The indirect costs (i.e. productivity losses) were included in the cost analysis because a societal perspective was adopted. The unit costs were not presented separately from the quantities of resources used. Wages for an average US female worker were estimated from the Bureau of Labor Statistics. The source of resource use was not stated. Discounting was applied. The price year was 2003.

Currency
US dollars ($).

Sensitivity analysis
Univariate sensitivity analyses were carried out to assess the robustness of the cost-utility ratios to variations in model inputs such as GDM prevalence, all probabilities and costs. The source of the alternative values and input ranges was not reported.

Estimated benefits used in the economic analysis
In the maternal model, at a GDM prevalence of 4%, the expected QALYs were 25.9219 with the sequential test, 25.9231 with the 100-g GTT, 25.9157 with the 75-g GTT and 25.9201 with no screening.

In the neonatal model, the expected QALYS were 29.9177 with the sequential test, 29.9190 with the 100-g GTT, 29.9108 with the 75-g GTT and 29.8985 with no screening.

Cost results
In the maternal model, at a GDM prevalence of 4%, the expected costs were $2,836 with the sequential test, $2,874 with the 100-g GTT, $2,895 with the 75-g GTT and $2,995 with no screening.

In the neonatal model, the expected costs were $77 with the sequential test, $89 with the 100-g GTT, $91 with the 75-g GTT and $80 with no screening.

Synthesis of costs and benefits
A cost-utility ratio was calculated to combine the costs and QALYs of the alternative screening strategies.
The sequential screening was the reference strategy. The incremental cost per QALY with 100-g GTT in comparison with the sequential test was $32,374 in the maternal model and $8,252 in the neonatal model.

The results of the sensitivity analyses were not reported.

**Authors’ conclusions**
The sequential test was the most cost-effective screening for gestational diabetes mellitus (GDM) in the USA.

**CRD COMMENTARY - Selection of comparators**
The authors justified their choice of the comparators, which represented widely used screening strategies for the detection of GDM. You should decide whether they are valid comparators in your own setting.

**Validity of estimate of measure of effectiveness**
The effectiveness data were estimated from published studies. It was not stated whether a systematic review of the literature was undertaken to identify the primary studies, which may have been used selectively. Limited information on the studies used to estimate the clinical inputs was provided. The issue of uncertainty in the data was addressed in the sensitivity analysis, although the results were not reported.

**Validity of estimate of measure of benefit**
QALYs are an appropriate benefit measure because they capture the impact of the intervention on both quality of life and survival, which are the most relevant dimensions of care. Details of the approach used to derive the utility weights were not reported. Further, the use of QALYs enables comparisons with the benefits of other health care interventions. Discounting was applied, as recommended in economic evaluation guidelines.

**Validity of estimate of costs**
The perspective adopted in the study was appropriate. All the categories of costs relevant to that perspective appear to have been included in the analysis. However, limited information on the cost analysis was provided. A breakdown of the cost items was not provided, and details of the unit costs and quantities of resources used were not presented. This limits the possibility of replicating the analysis in other settings. The source of the costs, but not resource consumption, was reported. Discounting was applied at the recommended rate. No statistical analyses of the costs were carried out and the results of the sensitivity analyses were not reported. The price year was reported, which enhances the possibility of performing reflation exercises in other time periods. Charges were used to derive the costs, but a cost-to-charge ratio was appropriately applied.

**Other issues**
The authors did not compare their findings with those from published studies. They also did not address the issue of the generalisability of the study results to other settings. The use of a sensitivity analysis was reported, but the results of this analysis were not. Thus, the external validity of the analysis was low. The authors pointed out the lack of well-established test parameters for the 75-g GTT in pregnancy and the paucity of data on newborn health utilities. It was also noted that the analysis did not take the potential effects of the intrauterine environment on the long-term health of the offspring into consideration.

**Implications of the study**
The study results support the use of sequential screening for GDM in the USA. The authors suggested that the 100-g GTT could be a cost-effective strategy in populations where GDM is more prevalent (i.e. Hispanics).

**Source of funding**

**Bibliographic details**


**PubMedID**

15920072

**Other publications of related interest**


**Indexing Status**

Subject indexing assigned by NLM

**MeSH**

Cost-Benefit Analysis; Diabetes, Gestational /diagnosis; Female; Humans; Infant, Newborn; Mass Screening /economics; Medicare; Models, Biological; Pregnancy; United States

**AccessionNumber**

22005000948

**Date bibliographic record published**

30/04/2006

**Date abstract record published**

30/04/2006