Cost-effectiveness analysis of gestational diabetes mellitus screening in France

Poncet B, Touzet S, Rocher L, Berland M, Orgiazzi J, Colin C

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 gestational diabetes mellitus were examined:

strategy one (S1), screening of high-risk pregnant women with the 50 g oral glucose tolerance test (OGTT);

strategy two (S2), screening of all pregnant women with the 50 g OGTT; and

strategy 3 (S3), screening of all pregnant women with the 75 g OGTT.

The 50 g OGTT requires confirmation by the 100 g OGTT, while the 75 g OGTT load in the fasting state does not require confirmation and is recommended by the World Health Organisation.

Type of intervention
Screening.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised the general population of women between the 24th and 28th week of gestation. The risk factors (used in strategy S1) considered were a family history of diabetes in first-degree relatives, age over 3 years, and a body mass index greater than 27 kg/m². Also, pregnancy complicated previously by gestational diabetes mellitus, pre-eclampsia or foetal death after 3 months' gestation, and prior delivery of a child weighing at least 4,000 g.

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

Dates to which data relate
The effectiveness data were derived from studies published between 1973 and 1998. The resource use data were collected between February and April 1999. The price year was not explicitly reported.

Source of effectiveness data
The effective evidence was derived from a review of published studies.

Modelling
A decision tree analysis was constructed to assess the costs and benefits of the screening strategies. Also, to calculate the cost-effectiveness ratios (CERs). A hypothetical group of 100 deliveries was considered, although the complete structure of the decision tree was not reported.
Outcomes assessed in the review
The primary health outcomes assessed from the primary studies were macrosomia, prematurity, perinatal mortality and hypertension disorders in patients with either no, treated or untreated gestational diabetes. The probability values of the following were also assessed:

gestational diabetes prevalence;
the presence of risk factors with or without gestational diabetes;
the woman agreeing to the 50 g OGTT if she had risk factors;
the sensitivity and specificity of the 50 g OGTT;
the woman agreeing to the 100 g OGTT if she had risk factors;
the sensitivity and specificity of the 100 g OGTT;
the success of the diet in women with risk factors;
the woman agreeing to the 50 g and 100 g OGTT;
the success of the diet;
the woman agreeing to the 75 g OGTT; and
the sensitivity and specificity of the 75 g OGTT.

Study designs and other criteria for inclusion in the review
The authors did not report the design of the primary studies included in the review, but the sample size and the study period were indicated.

Sources searched to identify primary studies
MEDLINE was searched for relevant primary studies. In addition, articles referred to in the selected articles were included.

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

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

Number of primary studies included
The effectiveness evidence was derived from 38 primary studies.

Methods of combining primary studies
The average outcome value derived from each primary study was weighted by the size of the studied sample.

Investigation of differences between primary studies
Results of the review
Macrosomia was 9.8% (range: 5.6 - 20) in patients with no gestational diabetes, 16.8% (range: 12 - 29) in patients with treated gestational diabetes, and 23.4% (range: 18.7 - 30.9) in patients with untreated gestational diabetes.

Prematurity was 9% (range: 3.1 - 20.5) in patients with no gestational diabetes, 10.3% (range: 4.2 - 15) in patients with treated gestational diabetes, and 22.5% (range: 4.5 - 26) in patients with untreated gestational diabetes.

Perinatal mortality was 0.62% (range: 0.3 - 2.7) in patients with no gestational diabetes, 0.93% (range: 0.6 - 3.2) in patients with treated gestational diabetes, and 16.4% (range: 6.4 - 26.4) in patients with untreated gestational diabetes.

Hypertension disorders were 8.2% (range: 2.2 - 12) in patients with no gestational diabetes, 16.3% (range: 10.4 - 20) in patients with treated gestational diabetes, and 21.1% (range: 17 - 25) in patients with untreated gestational diabetes.

The baseline probabilities used in the decision model were:

- 0.030 (range: 0.014 - 0.080) for gestational diabetes prevalence;
- 0.633 (range: 0.467 - 0.913) for the presence of risk factors with gestational diabetes and 0.516 (range: 0.275 - 0.540) without gestational diabetes;
- 0.663 (range: 0.640 - 0.763) for the woman agreeing to the 50 g OGTT if she had risk factors;
- 0.790 (range: 0.6-1) for the sensitivity and 0.870 (range: 0.6 - 1) for the specificity of the 50 g OGTT;
- 0.877 (range: 0.863 - 0.9) for the woman agreeing to the 100 g OGTT if she had risk factors;
- 1 (range: 0.6 - 1) for both the sensitivity and specificity of the 100 g OGTT;
- 0.736 (range: 0.650 - 0.823) for the success of the diet in women with risk factors;
- 0.663 (range: 0.640 - 0.763) for the woman agreeing to the 50 g OGTT, and 0.877 (range: 0.863 - 0.9) for the woman agreeing to the 100 g OGTT;
- 0.736 (range: 0.650 - 0.823) for the success of the diet;
- 0.859 (range: 0.5 - 0.9) for the woman agreeing to the 75 g OGTT; and
- 1 (range: 0.6 - 1) for the sensitivity and 0.855 (range: 0.6 - 1) for the specificity of the 75 g OGTT.

Measure of benefits used in the economic analysis
The benefit measures used in the economic analysis were the expected values of macrosomia, prematurity, perinatal mortality and hypertension disorders (rates for 100 deliveries). All were obtained using the decision model. No discounting was applied, which was appropriate given the relatively short study period.

Direct costs
Discounting was irrelevant due to the short time horizon of the study (3 months). The unit costs and the quantities of resources were not reported. The health services included in the analysis were study tests, obstetrical follow-up, management of diabetes mellitus and delivery care. Obstetrical follow-up included obstetrical consultation, ultrasound scan, urinary cytobacteriology and hospitalisation. Management of diabetes mellitus included endocrinology consultations, dietician consultations, biological tests, drugs and hospitalisation. The long-term consequences of gestational diabetes mellitus after delivery were not considered in the economic analysis. The cost/resource boundary
adopted in the analysis was that of the French health insurance system. The costs and resources were estimated from a prospective study of 120 pregnancies from 15 February to 11 April 1999 at a public hospital in the Rhone-Alpes region. The source of the cost data was the French key-letters costing system for tests, consultations and procedures. The hospitalisation costs were derived from the French equivalent of the diagnosis related group. No price year was explicitly reported.

**Statistical analysis of costs**
The costs were treated deterministically in the base-case.

**Indirect Costs**
The costs of sick leave were included in the analysis. These were estimated using the same prospective study of 120 pregnancies carried out to estimate the direct costs. The unit costs were not reported separately from the quantities of resources. Discounting was not relevant as the indirect costs were assessed over 3 months. The source of the cost data was the official French health insurance system. No price year was reported.

**Currency**
Euros (EUR).

**Sensitivity analysis**
Several sensitivity analyses were performed to test the robustness of the estimated CERs. All the parameters included in the decision model were varied. The type of analysis was not stated.

**Estimated benefits used in the economic analysis**
The expected rates of macrosomia were 10.208% with S0, 10.150% with S1, 10.117% with S2, and 10.038% with S3.

The expected rates of prematurity were 9.405% with S0, 9.284% with S1, 9.213% with S2, and 9.091% with S3.

The expected rates of perinatal mortality were 1.093% with S0, 0.940% with S1, 0.850% with S2, and 0.695% with S3.

The expected rates of hypertension disorders were 8.587% with S0, 8.545% with S1, 8.521% with S2, and 8.463 with S3.

**Cost results**
The expected cost per woman was EUR 5,017.86 with S0, EUR 5,029.90 with S1, EUR 5,038.90 with S2, and EUR 5,134.94 with S3.

**Synthesis of costs and benefits**
Average and incremental cost-effectiveness analyses were performed to combine the costs and benefits of the screening strategies.

The average cost per prevented case of macrosomia was EUR 5,588.32 with S0, EUR 5,598.08 with S1, EUR 5,606.01 with S2, and EUR 5,708 with S3.

The average cost per prevented case of prematurity was EUR 5,538.78 with S0, EUR 5,544.57 with S1, EUR 5,550.21 with S2, and EUR 5,648.54 with S3.

The average cost per prevented case of perinatal mortality was EUR 5,073.20 with S0, EUR 5,077.62 with S1, EUR 5,082.04 with S2, and EUR 5,170.92 with S3.
The average cost per prevented case of hypertension disorders was EUR 5,489.23 with S0, EUR 5,499.75 with S1, EUR 5,508.29 with S2, and EUR 5,610.12 with S3.

In comparison with the "no screening" option, the incremental CERs were:

EUR 21,069.52 with S1, EUR 23,135.36 with S2, and EUR 68,933.79 with S3 per prevented case of macrosomia;

EUR 9,953.24 with S1, EUR 10,965.20 with S2, and EUR 37,320.89 with S3 per prevented case of prematurity;

EUR 7,871.55 with S1, EUR 8,663.83 with S2, and EUR 29,444.16 with S3 per prevented case of perinatal mortality; and

EUR 28,674.90 with S1, EUR 31,898.74 with S2, and EUR 94,506.04 with S3 per prevented case of hypertension disorders.

The estimated incremental CERs were robust to variations in the probability values, but within a variation of 9.5% of the costs, S3 was the most cost-effective.

Authors' conclusions
The strategy of screening high-risk pregnant women with the 50 g oral glucose tolerance test (OGTT) represented the most cost-effective option for the detection of gestational diabetes mellitus in the general population of women between the 24th and 28th week of gestation.

CRD COMMENTARY - Selection of comparators
The three screening strategies were selected as they all represented possible options for the detection of gestational diabetes mellitus. The option of "no screening" was also included to perform the marginal analysis. You should decide whether they represent valid comparators in your own setting.

Validity of estimate of measure of effectiveness
The effectiveness analysis used a systematic review of primary studies. The search methods were clearly reported. The authors reported the sample size of each study and the period during which the data were collected. The effectiveness estimates were combined using a weighting scheme to reflect differences in the sample sizes. Extensive sensitivity analyses were performed to take into account variability in the effectiveness values reported in the primary studies.

Validity of estimate of measure of benefit
No single benefit measure was used. The four outcome measures used in the economic analysis were derived from the decision model.

Validity of estimate of costs
The perspective adopted in the study was reported. It would appear that all the relevant categories of costs were included in the analysis. A complete breakdown of the costs was given. The costs of sick leave, as reimbursed by the insurance system, were also included. The source of the cost data was reported. The unit costs and the quantities of resources were not reported. No price year was given, thus limiting the possibility of reflation exercises to other settings. Discounting was not relevant. The cost estimates were specific to the French setting.

Other issues
The authors made several comparisons of their findings with those from other studies. The issue of the generalisability of the study results to other settings was not explicitly addressed. However, several sensitivity analyses were performed on the costs and effectiveness values. The study referred to the general population of women between the 24th and 28th week of gestation, and this was reflected in the conclusions of the analysis.
Implications of the study
The authors suggest that further research should be based on a long-term study observing both women and children over a 30-year period. The adoption of the patients' viewpoint and the inclusion of expenses, such as transport, baby-sitting, housekeeping and quality of life loss, would also be interesting.

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