Cost-effectiveness of different treatment strategies with intrapartum antibiotic prophylaxis to prevent early-onset group B streptococcal disease


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
Different strategies to prevent early-onset group B streptococcal (GBS) disease by the use of intrapartum antibiotic prophylaxis (IAP) were examined. The strategies included a risk-based strategy, a screening-based strategy, a combined screening and risk-based strategy, and the current Dutch guideline. The authors also explored these strategies when replacing the culture test taken at 35- to 37-weeks' gestation with the new polymerase chain reaction (PCR) technique during labour.

Type of intervention
Screening.

Economic study type
Cost-utility analysis.

Study population
The population comprised pregnant women and neonates.

Setting
The setting was secondary care. The economic study was performed in Leiden, The Netherlands.

Dates to which data relate
Probabilities for the model were obtained from the literature. These data were retrieved from articles published between 1992 and 2002. The dates to which quality of life data, resources used and costs referred were not reported. The price year was also not reported.

Source of effectiveness data
Data used to populate the model were obtained from a review of studies and were also derived from opinion (a survey among parents of children affected by GBS disease).

Modelling
A decision analysis model was used. The strategies considered were as follows.

A risk-based strategy with IAP for all women with at least one of the following clinical risk factors: prelabour rupture of membranes after 18 hours, preterm birth (before 37 weeks), intrapartum fever (higher than 37.5 degrees C), bacteriuria caused by GBS during pregnancy, or a previous child with GBS.

The current strategy proposed by the Dutch Association of Obstetrics and Gynecology (NVOG) with IAP for women
with intrapartum fever higher than 37.5 degrees C, bacteriuria caused by GBS, or a previous child with GBS. In women with preterm labour (before 37 weeks) or prolonged prelabour rupture of membranes (after 18 hours), a culture is taken. The caregiver is advised by the guideline to use the test result in the decision whether to give IAP to the woman. However, as it takes about 2 days before the results of the culture are known, women with preterm labour or prolonged prelabour rupture of membranes will already have delivered their baby. Therefore, the authors assumed that women with preterm labour or prolonged prelabour rupture of membranes do not receive IAP in this strategy.

A screening-based strategy with a culture taken at 35- to 37-weeks' gestation and IAP for all GBS colonised women. IAP is given in all cases of (unscreened) preterm labour.

A combined screening and risk-based strategy consisting of a culture taken at 35- to 37-weeks' gestation and IAP only for the GBS colonised women with risk factors, and not for those without risk factors. IAP is also given in all cases of (unscreened) preterm labour.

Outcomes assessed in the review
The following model parameter values were obtained from an ad hoc review of the literature. The major effectiveness parameters included in the model were the test characteristics, that is, the sensitivity and sensitivity of the screening test (week 36) and the PCR test. Other parameters included the probability of risk factors, consequences of GBS cases and non-GBS cases, and the adequateness of treatment.

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

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
Not reported.

Methods of combining primary studies
Not reported.

Investigation of differences between primary studies
Not reported.

Results of the review
Consequences of GBS cases and non-GBS cases:

preterm GBS cases with death 8.3%, term GBS cases with death 2.9%;
preterm GBS cases with long-term sequelae 11.1%, term GBS cases with long-term sequelae 1.6%; and preterm cases with death 0.3%, term cases with death 0.1%.

The screening test (week 36) had a sensitivity of 90.8% and a specificity of 88.9%.

The PCR test had a sensitivity of 100% and a specificity of 98.9%.

**Methods used to derive estimates of effectiveness**

Some event probabilities and/or costs were derived from a survey among parents of GBS children who are members of the Dutch Foundation of Parents of GBS children. No further details of the survey or the way in which its results were used were reported.

**Estimates of effectiveness and key assumptions**

Not reported.

**Measure of benefits used in the economic analysis**

The outcome measure used in the economic analysis was the quality-adjusted life-years (QALYs). The quality of life estimates for infants with early-onset GBS at age 2 to 8 years were obtained from a survey among parents who are members of the Dutch Foundation of Parents of GBS children using the HUI Mark III (based on visual analogue scale and standard gamble). The number of participants in the survey was not stated.

**Direct costs**

Patient, health service and other public sector costs were included in the analysis. The authors considered the following cost categories when calculating the costs: screening (midwife time and laboratory cost of culture), IAP, high- and low-risk birth, hospitalisation, medical aids, and type of education for infant previously diagnosed with early-onset GBS. These costs were divided into short-term costs (zero years of age), mid term costs (1 to 5 years of age) and long-term costs (more than 5 years of age). The authors used median figures to obtain the total cost per category for hospitalisation, medical aids and type of education. Discounting was carried out at a rate of 3% per year. The quantities and the costs were not analysed separately. Some unit costs were obtained from the literature (low- and high-risk deliveries). The costs of the strategies were derived using modelling. The dates for when resource use was measured or for the prices used were not reported.

**Statistical analysis of costs**

The costs were treated deterministically.

**Indirect Costs**

No indirect costs were reported.

**Currency**

Euros (Euro).

**Sensitivity analysis**

The authors performed a one-way sensitivity analysis, in which they halved and doubled the value of model parameters, to investigate the effects of some parameters on the model outcomes. The parameters investigated in the sensitivity analysis were the mortality rate among GBS cases, the percentage of infants with long-term sequelae and the long-term costs.
Estimated benefits used in the economic analysis
The length for which the benefits were assessed was 75 years. Adjustments for quality of life and discounting were
performed. Relative to a “do nothing” strategy, the QALYs gained for a cohort of 200,000 would be:

663 for the risk-based strategy,
186 for the Dutch guideline strategy,
766 for the screening-based strategy, and
650 for the combined risk and screening strategy.

Cost results
The total costs (discounted) for each strategy were:

risk-based strategy, Euro 5,021,600;
Dutch guideline, Euro 9,073,500;
screening-based strategy, Euro 45,416,000; and
combined risk and screening-based strategy, Euro 5,881,500.

No statistical analysis or incremental costs were reported.

Synthesis of costs and benefits
The estimates of costs and benefits were combined using average cost-effectiveness ratios for each strategy.

The cost-effectiveness ratio for each strategy was:

risk-based strategy, Euro 7,600;
Dutch guideline, Euro 48,800;
screening-based strategy, Euro 59,300; and
combined risk and screening-based strategy, Euro 9,100.

Introducing a PCR test appears to have lowered the costs and, consequently, produced lower average cost-effectiveness
ratios.

An incremental analysis was also performed. The combined risk and screening-based strategy with PCR test, risk-based
strategy and screening-based strategy were the efficient strategies when the others were all dominated by at least one of
these three. The combined screening and risk-based strategy using the PCR test was the most cost-effective strategy.
The other strategies resulted in greater effectiveness for higher costs.

The incremental cost-effectiveness ratio amounted to Euro 23,400 per QALY gained for the risk-based strategy
compared with the combined screening and risk-based strategy using the PCR test. The costs of the screening-based
strategy test were nine times the costs of the risk-based strategy, while the effects were only 15% higher. This resulted
in an incremental cost-effectiveness ratio of Euro 392,200 per QALY gained.

Varying the mortality rates, long-term sequelae rates and long-term costs did not have an impact on the ranking of the
cost-effectiveness of the strategies.
Authors' conclusions
In the Dutch system, the combined screening and risk-based strategy and the risk-based strategy have reasonable cost-effectiveness ratios. If it becomes feasible to add a polymerase chain reaction (PCR) test, the cost-effectiveness of the combined screening and risk-based strategy may be even more favourable.

CRD COMMENTARY - Selection of comparators
No explicit justification was stated for the technologies chosen, but one of them was reported as being current practice at the authors’ setting. The reader should decide if the comparator represents current practice in his or her own setting.

Validity of estimate of measure of effectiveness
No systematic review of the literature was undertaken. Although this is common practice with models, it does not always ensure that the best data available are used in the model. The authors appear to have used data from the available studies selectively.

Validity of estimate of measure of benefit
The authors used the QALYs as a measure for the economic analysis. They reported the methods used but not details of the survey, thus it is not possible to comment on these estimates. Moreover, the authors acknowledged that it is likely that parents with children with more severe consequences of GBS disease might be more likely to become members of the foundation, and the survey might have underestimated the quality of life of the early-onset GBS patients.

Validity of estimate of costs
The authors reported that the study had been conducted from a societal perspective. However, the indirect costs were not included. All the relevant categories for the direct costs appear to have been included in the analysis. The resource use estimates were, in part, based on a survey among parents who were members of the Dutch Foundation of Parents of GBS patients. As the authors stated, this might have overestimated the costs of the early-onset GBS patients. The costs and the quantities have not been reported separately, and this might present obstacles to future replications of the model in other settings. No sensitivity analysis of the resources used was performed, which may limit the interpretation of the study findings. Discounting was performed. However, the authors did not report the dates to which the cost data related, or the price year used in the analysis, and this will make future reflation of the model's findings impossible.

Other issues
The authors compared their findings with those from other studies and attempted to explain the differences in the results. The issue of generalisability was implicitly addressed when discussing the limitations of the results to the specificities of the study setting of the hypothetical population. The authors reported further limitations of their analysis. For example, they assumed 100% adherence to the treatment strategy under study when, in practice, this will be lower. This would negatively influence the effectiveness and might change the ranking in cost-effectiveness of the strategies. The authors’ conclusions reflected the scope of the analysis.

Implications of the study
In the Dutch system, the risk-based strategy is an efficient strategy with reasonable cost-effectiveness. The cost and effects of the combined screening and risk-based strategy are close to the results of the risk-based strategy. The next step should involve further research on the performance of the risk-based strategy and the combined screening and risk-based strategy in practice. In addition, the feasibility of the use of the PCR test in Dutch clinical practices needs to be closely monitored to choose the strategy most applicable in this setting.

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