Newborn hearing screening: costs of establishing a program
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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
Two universal newborn hearing screening programmes, one using automated auditory brainstem response (AABR) and the other transient evoked otoacoustic emissions (TEOAE), were examined. Detailed pass criteria were reported for both programmes. The main difference between the two screening approaches was that AABR was performed by neonatal nurses, while TEOAE was conducted by master's level audiologists.

Type of intervention
Screening.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised newborns who were screened before discharge from the nursery.

Setting
The setting was a hospital. The economic study was carried out at the Rainbow Babies' and Children's Hospital in Cleveland (OH) for the TEOAE programme and at the Wishard Memorial Hospital in Indianapolis (IN) for the AABR programme.

Dates to which data relate
The effectiveness and resource use data were gathered in 1999. The price year was 1999.

Source of effectiveness data
The effectiveness evidence was derived from a single study.

Link between effectiveness and cost data
The costing was performed prospectively on the same sample of patients as that used in the effectiveness study.

Study sample
Power calculations do not appear to have been conducted. Two samples of consecutive newborns were selected from each study centre until 1,500 children were screened, or a 5% or lower referral rate was achieved for two consecutive months. A 5% referral rate suggested that the site was trained and no longer in the start-up phase. The final study samples comprised 1,530 newborns in the TEOAE group and 1,412 newborns in the AABR group. The average age at initial screening was 29 hours in the TEOAE group and 9.5 hours in the AABR group.
Study design
This was a prospective cohort study, which was carried out in two medical centres. The outcome data were collected on the initial screen and re-screen. The length of follow-up was not stated. No loss to follow-up appears to have occurred. Independent site audits were performed regularly to ensure the quality of the collected data.

Analysis of effectiveness
It appears that all the children included in the initial study sample have been considered in the effectiveness analysis. The primary health outcome used in the economic analysis was the rate of referral observed over the study period. The rate of children successfully screened, and the percentages of children screened prior to 6 hours and within 24 hours after birth were also evaluated. No statistical analysis to assess the baseline comparability of the groups was performed. However, the authors underlined the differences among the two study sites in characteristics such as type of screener (e.g. nurse), number of screeners, age at initial screen and mean nursery discharge age.

Effectiveness results
The average referral rate at hospital discharge was 15.7% in the TEOAE group and 6.5% in the AABR group.

The referral rate remained significantly high (around 15%) throughout the entire study period in the TEOAE group, whilst it decreased from an initial 8.3% to a final 4% in the AABR group, thus showing a learning curve.

The rate of children successfully screened was 99% in the TEOAE group and 96% in the AABR group.

The percentages of children screened prior to 6 hours and within 24 hours after birth were 50% and 84% in the TEOAE group, while only 34% of newborns were screened within 24 hours in the AABR group.

Clinical conclusions
The clinical study showed that the referral rate was far lower in the AABR group than in the TEOAE group. This indicated that the AABR led to a faster completion of the start-up phase.

Measure of benefits used in the economic analysis
No summary benefit measure was used in the economic evaluation. The analysis was therefore classified as a cost-consequences analysis.

Direct costs
Discounting was not relevant since the costs were incurred during a short time. The unit costs were analysed separately from the quantities of resources used. The health services included in the economic evaluation were personnel type, screening time, time invested in scheduling and follow-up for re-screen, time devoted to administrative management of the programme, training costs of personnel, and equipment. The cost/resource boundary adopted in the study was not explicitly stated, but it could have been that of the hospital performing the screening procedure. Resource use was estimated using individualised data, which referred to the same children as those involved in the effectiveness study. The unit costs were estimated from the US Bureau of Labor Statistics and published studies. The price year was 1999.

Statistical analysis of costs
The costs were treated deterministically.

Indirect Costs
The indirect costs were not included.
Currency
US dollars ($).

Sensitivity analysis
Sensitivity analyses were not conducted.

Estimated benefits used in the economic analysis
See the 'Effectiveness Results' section.

Cost results
The total start-up costs of the screening programmes were $49,316 in the TEOAE group and $47,473 in the AABR group.

The cost per infant screened was $32.23 in the TEOAE group and $33.68 in the AABR group.

When the impact of referral rate was considered, the estimated post-discharge screening costs were $39,527 in the TEOAE group and $17,186 in the AABR group, reflecting the lower referral rate in the latter group.

When the impact of referral rate was considered, the cost per infant screened increased to $58.07 for TEOAE and to $45.85 for AABR.

Synthesis of costs and benefits
Not relevant because a cost-consequences analysis was conducted.

Authors' conclusions
Automated auditory brainstem response (AABR) proved to be the preferred option for universal screening of newborn hearing. Both the post-discharge costs and referral rate were far lower in the AABR group than in the transient evoked otoacoustic emissions (TEOAE) group.

CRD COMMENTARY - Selection of comparators
In terms of the choice of the comparators, the authors stated that AABR and TEOAE represented two of the most common newborn hearing screening options used in the USA. You should decide whether they are appropriate comparators in your own setting.

Validity of estimate of measure of effectiveness
The analysis of effectiveness used a prospective cohort study, which was appropriate for the study question. Randomisation was not performed when the patients were allocated to the study interventions because each screening procedure was conducted in a different site. Thus, some selection bias may have affected the outcome measures. Further, the authors did not comment on the baseline comparability of the two hospitals. Power calculations were not reported, but the sample size was quite large. The study sample was unselected and was therefore likely to have been representative of the study population. Two independent reviewers revised the collected data, to ensure a control on the information used to measure the study outcomes. The authors stated that the two programmes differed in several critical characteristics, which in principle should have favoured the TEOAE programme (according to earlier studies). Nevertheless, the AABR option reached and maintained the lowest referral rate.

Validity of estimate of measure of benefit
No summary benefit measure was used in the economic analysis. The analysis was therefore categorised as a cost-
Validity of estimate of costs
The perspective adopted in the study was not explicitly reported, although it appears to have been that of the medical centres where the screenings were performed. The unit costs and the quantities of resources used were analysed separately, and the price year was reported. This enhances the reproducibility of the study in other settings. However, sensitivity analyses were not conducted and the cost estimates were specific to the study setting. The source of the cost data was reported. The costs were treated deterministically. The authors identified the major determinants of the cost analysis.

Other issues
The authors compared some of their findings with those from other studies. However, they did not address the issue of the generalisability of the study results to other settings. Sensitivity analyses were not conducted and the overall external validity of the analysis was low. The study referred to newborns and this was reflected in the conclusions of the analysis.

Implications of the study
The study results showed that the AABR programme should be considered the preferred option for universal newborn hearing screening, because it leads to a very low referral rate and is associated with some cost-savings in comparison with TEOAE screening. The authors noted that personnel and referral rate are the key factors for the success of the programme.

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