A comparison of four methods of normal newborn temperature measurement

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
Four different methods to measure the temperature of newborn babies were compared. The methods were:

- a glass mercury thermometer using the left axilla;
- a tympanic thermometer (IVAC Core Check Aural Infrared; IVAC Corp.) with disposable probe covers, using the left ear;
- an electronic thermometer (IVAC Temp Plus II, model 2080), with disposable probe covers using the left axilla; and
- a digital disposable thermometer (Steridyne MT 1681; Steridyne Corp.), also using the left axilla.

For each baby the glass thermometer was used first, followed by the other three methods in a random order.

Type of intervention
Other: Management.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised healthy newborn babies aged between 1 and 168 hours old.

Setting
The setting was secondary and community care. The economic study was carried out in south-eastern USA.

Dates to which data relate
The dates to which the effectiveness evidence and resource use data related were not reported. The price year was also not reported.

Source of effectiveness data
The effectiveness data were derived from a single study.

Link between effectiveness and cost data
The same patients provided the effectiveness data and the cost data. It was unclear whether the costing was carried out prospectively or retrospectively.
Study sample
No power calculations were reported. Medical record numbers were used to select a stratified convenience sample. A total of 184 babies were included in the study.

Study design
This was a correlation study, carried out in two centres, in which all patients were subjected to all four methods of temperature measurement. Twelve perinatal and neonatal nurses took the temperature measurements.

Analysis of effectiveness
The authors assessed the mean temperature and the range of temperature for each method, and also the correlation coefficient for temperature measurements between the four methods. The glass mercury thermometer was used as the reference method. The range of results obtained by each assessment method was also recorded and compared.

Effectiveness results
The correlation coefficient was 0.84 between the glass mercury thermometer and the digital thermometer, 0.74 between the glass mercury thermometer and the electronic thermometer, and 0.35 between the glass mercury thermometer and the tympanic thermometer.

The mean temperature was:
- 98.18 F (standard deviation, SD=0.531; range: 96.0 - 100.2) with the glass mercury thermometer,
- 98.08 F (SD=0.568; range: 96.3 - 100.2) for the electronic thermometer,
- 98.14 F (SD=0.534; range: 96.1 - 99.7) for the digital thermometer, and
- 98.58 F (SD=1.055; range: 96.9 - 101.5) for the tympanic thermometer.

Clinical conclusions
Digital and electronic thermometers were more accurate than tympanic thermometers.

Measure of benefits used in the economic analysis
No summary measure of benefits was produced. In effect, the authors carried out a cost-consequences analysis.

Direct costs
Discounting was not carried out as the costs were incurred during less than 2 years. The unit costs and the quantities were analysed separately. The costs of the thermometer (instruments and supplies) and the nursing time necessary to take the temperature were measured. The instrument and supply costs were estimated from actual data. The source of the thermometer prices was not given. The authors measured nursing time as an average of 10 observations of the nurses. The time to prepare the equipment and position the infant was not included. The nursing time unit cost was derived from the average of registered nurses' and licensed practical nurses' salaries. No price year was reported.

Statistical analysis of costs
No statistical analysis of the costs was carried out.

Indirect Costs
No indirect costs were measured.
Currency
US dollars ($).

Sensitivity analysis
No sensitivity analysis was carried out.

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

Cost results
The costs for a year's delivery of 6,400 babies were given. These were $59,520 for glass mercury thermometers, $15,296 for electronic thermometers, $43,520 for digital thermometers, and $5,045 for tympanic thermometers.

The costs of adverse effects were not included.

Synthesis of costs and benefits
The costs and benefits were not combined as the study, was, in effect, a cost-consequences analysis.

Authors' conclusions
The electronic and tympanic thermometers were shown to be more cost-effective than the glass mercury thermometer and the digital thermometer in healthy newborns. However, the electronic and tympanic thermometers have a risk of cross contamination because they are multiple-use instruments. Thus, the use of digital thermometers should be encouraged if there is any concern about using glass thermometers.

CRD COMMENTARY - Selection of comparators
The choice of the comparators was justified by all four being commonly used methods of measuring the temperature of new born babies. You should decide if the comparators represent current practice in your own setting.

Validity of estimate of measure of effectiveness
The source of the effectiveness data was a single study. The study assessed the correlation of temperature measurement as a measure of effectiveness. However, the authors reported possible drawbacks associated with each method, without making any attempt to assess the prevalence of these drawbacks. The study sample appears to have been representative of the study population as there was no sample selection.

Validity of estimate of measure of benefit
The authors did not derive a summary measure of health benefit. The health benefits were, therefore, those associated with the effectiveness outcomes.

Validity of estimate of costs
The authors calculated the costs from the perspective of the hospital, but they did not include any of the costs associated with possible harmful consequences of some methods of temperature measurement. It is difficult to know whether including these costs would have affected the authors' conclusions. The costs were reported separately from the quantities, which will help the generalisability of the results to other settings. The resource use quantities were taken from a single study, while the unit costs were taken from the authors' setting. No statistical or sensitivity analyses of the quantities or prices were carried out, and this limits the interpretation of the results. No price year was reported, which
will prevent any possible inflation exercises. Discounting was not relevant, as all the costs were incurred during a short time, and hence was not performed.

**Other issues**  
The authors did not compare their findings with those from other studies. The issue of generalisability to other settings was not addressed. The authors do not appear to have presented their results selectively and their conclusions reflected the scope of the analysis. However, the authors did not seem to be aware of the limited usefulness of the effectiveness outcomes that they provided. The authors did not report any limitations of their study.

**Implications of the study**  
The authors reported that their institution decided to use the digital thermometer because it offers the best outcomes, as it is highly correlated with the glass mercury thermometer, it does not carry the risk of cross contamination that is associated with electronic and tympanic thermometers, and it does not have the side effects of glass mercury thermometers. The authors recommended further research with a larger sample and in a different area of the country in order to assess the financial consequences of using less highly trained staff to measure temperature.

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