Cost-effectiveness of therapeutic hypothermia after cardiac arrest

Merchant RM, Becker LB, Abella BS, Asch DA, Groeneveld PW

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.

CRD summary
This study evaluated the cost-effectiveness of therapeutic hypothermia for patients following witnessed ventricular fibrillation and out-of-hospital cardiac arrest, compared with conventional care. The authors concluded that therapeutic hypothermia improved the clinical outcomes and was cost-effective in the USA. The methods were appropriate and the results were reported in full. The conclusions appear to be appropriate, but more details of the methods used to obtain the outcome and cost information would have been useful.

Type of economic evaluation
Cost-utility analysis

Study objective
The objective was to evaluate the cost-effectiveness of therapeutic hypothermia for patients following witnessed ventricular fibrillation and out-of-hospital cardiac arrest (OHCA), compared with conventional care.

Interventions
Hypothermia, induced with a cooling blanket, was compared with care, after a cardiac arrest, that did not include hypothermia (i.e. conventional care).

Location/setting
USA/in-patient secondary care.

Methods
Analytical approach:
A decision-analytic model and data from published studies were used to simulate a hypothetical cohort of comatose patients who had experienced the return of spontaneous circulation after a witnessed ventricular fibrillation OHCA. The time horizon was the lifetime of the patient and the authors stated that the study perspective was societal.

Effectiveness data:
The effectiveness data were from published literature. The authors reported that most of the estimates used in the model were from a single randomised controlled trial (Hypothermia after Cardiac Arrest Study Group. 2002, see 'Other Publications of Related Interest' below for bibliographic details). The main clinical effectiveness estimate was the neurological outcomes of the patients, which were based on Cerebral Performance Category scores.

Monetary benefit and utility valuations:
Quality of life data for cardiac arrest survivors was obtained from the published literature.

Measure of benefit:
Quality-adjusted life-years were the benefit measure.

Cost data:
The costs included those of the cooling devices, blankets, and pads; nurse time; staff training; tubing and intravenous fluids; emergency visits; intensive care unit stay; and care following hospital discharge. The costs were from the manufacturers of the cooling equipment, the authors of RCTs, and hospital administrators. The costs of standard equipment for intensive care were from purchasing administrators at two large academic institutions. The estimates of equipment depreciation were from device manufacturers and those for equipment usage were from hospital equipment.
administrators. Care costs were from published Markov models. All costs were reported in 2008 prices, and the currency was US dollars ($).

Analysis of uncertainty:
A series of one- and two-way sensitivity analyses was undertaken by varying each model parameter across a wide range of values. All parameters were assigned a distribution, and 10,000 Monte Carlo simulations were performed to assess the overall variability in the costs and outcomes, and the proportion of simulations below a $100,000 per QALY threshold. The results of the one-way sensitivity analyses were presented in a tornado diagram, while those of the probabilistic sensitivity analysis were presented in a scatter plot.

Results
Patients treated with therapeutic hypothermia gained an average of 0.66 QALYs over those receiving conventional care and the incremental cost per patient was $31,254. Compared with conventional care, the incremental cost utility ratio for therapeutic hypothermia was $47,168 per QALY gained.

The one-way sensitivity analysis found that the most influential variables were the probability of poor neurological outcome after hypothermia and the cost of care after hypothermia. The two-way sensitivity analysis found that when the hypothermia group had 5% more patients with poor neurological outcomes, than the conventional care group, the incremental cost-utility ratio exceeded $100,000 per QALY.

The probabilistic sensitivity analyses showed that the probability that therapeutic hypothermia was cost-effective, at a threshold of $100,000 per QALY, was 91%.

Authors’ conclusions
The authors concluded that therapeutic hypothermia, with a cooling blanket, improved the clinical outcomes and was cost-effective, in the USA.

CRD commentary
Interventions:
The interventions were reported clearly and in detail. The justification for using acute care without hypothermia as the comparator, was that it was the usual care in the authors’ settings. These interventions might be appropriate comparators in other settings.

Effectiveness/benefits:
The methods used to identify the effectiveness estimates for the model were not reported and the data were mainly from one randomised controlled trial. It was not clear if a systematic review was undertaken to ensure that all the relevant information was included. The benefit measure was appropriate, but the details on how the utilities were estimated were not presented making it difficult to assess the validity of the data. Discounting was not reported, but the data were from studies that might have included discounting, which makes it difficult to assess whether this was appropriate.

Costs:
The authors reported that a societal perspective was adopted, but it was unclear if the authors included productivity lost due to mortality or morbidity. Adequate details were provided on how the direct resource use was estimated, and how the costs were calculated. The price year was reported. As with the benefit measure, discounting was not clearly reported.

Analysis and results:
All the cost and outcome information was appropriately synthesised, using a decision analytic model, and a diagram was given. The impact of uncertainty in the results was tested in a series of one- and two-way sensitivity analyses, as well as a probabilistic sensitivity analysis. The authors reported a number of limitations to their study, the main one being that most of the effectiveness estimates were from one trial, with less than 400 patients.

Concluding remarks:
The methods were appropriate and the results were reported in full. The conclusions appear to be valid, but more detail of the methods used to obtain the outcome and cost information would have been useful.

**Funding**
Supported by the Robert Wood Johnson Foundation, and the Veterans Affairs Health Services Research and Development Service.

**Bibliographic details**

**PubMedID**
20031872

**DOI**
10.1161/CIRCOUTCOMES.108.839605

**Original Paper URL**
http://circoutcomes.ahajournals.org/content/2/5/421.abstract

**Other publications of related interest**

**Indexing Status**
Subject indexing assigned by NLM

**MeSH**
Cardiopulmonary Resuscitation /economics; Cost-Benefit Analysis; Decision Support Techniques; Heart Arrest /economics /therapy; Humans; Hypothermia, Induced /economics /instrumentation; Models, Econometric; Monte Carlo Method; Patient Discharge; Quality-Adjusted Life Years; Treatment Outcome; United States; Ventricular Fibrillation /economics /therapy

**AccessionNumber**
22010000693

**Date bibliographic record published**
21/07/2010

**Date abstract record published**
16/03/2011