Potential cost-effectiveness of public access defibrillation in the United States

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
Treatment for out-of-hospital sudden cardiac arrest by public access defibrillation as opposed to standard emergency medical services (EMS).

Type of intervention
Treatment.

Economic study type
Cost-utility analysis.

Study population
Hypothetical urban population.

Setting
Community. The economic study was carried out in the United States.

Dates to which data relate
The probability of survival to hospital admission for standard EMS was taken from a meta-analysis published in 1996. The data relevant to other parameters of the model were extracted from a review/synthesis of studies published between 1966 and 1997. Resource and cost data were assumed or communicated by experts. The costs were expressed in 1996 values.

Source of effectiveness data
The effectiveness data were derived from a review of previously completed studies and a meta-analysis.

Modelling
A decision tree was constructed to compare costs and outcomes after out-of-hospital cardiac arrest treated by each programme. Monte Carlo simulation was performed to estimate the variability in the costs and effects of each programme.

Outcomes assessed in the review
The outcomes assessed in the review were used to derive a probability distribution for all the variables included in the decision tree. These outcomes included survival rates, benefits of PAD, life expectancy and utilities.

Study designs and other criteria for inclusion in the review
No specific inclusion criteria were reported by the authors. Only randomised controlled trials or prospective studies were retained.

**Sources searched to identify primary studies**
The search was limited to the English-language MEDLINE database from 1966 to 1997.

**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 number of primary studies was approximately 15.

**Methods of combining primary studies**
Not stated. For the survival probability under standard EMS, the authors chose a study which was a meta-analysis of previous studies.

**Investigation of differences between primary studies**
Not stated.

**Results of the review**
Survival rates from hospital admission to discharge and overall survival rates to hospital discharge were estimated to be 32% (range: 24 - 40%) and 8% (range: 0 - 25%) respectively. The authors used a relative benefit of PAD of 1.5 (range: 1.05 - 2.2). Life expectancy and utility levels of survivors of cardiac arrest were 5.61 (range: 4.79 - 6.62) and 0.72 (range: 0.68 - 0.78), respectively.

**Measure of benefits used in the economic analysis**
The measure of benefits used was Quality Adjusted Life Years (QALYs). The quality of life of survivors of cardiac arrest was estimated from a previously published study.

**Direct costs**
The quantity/cost boundary adopted was that of society at large. Direct costs included the purchase cost of an automated external defibrillator, annual training and maintenance costs, the cost of police defibrillation and hospitalisation costs. The cost of treatment by EMS (common to both strategies) and future costs were not included. Quantities were not reported separately from prices.

**Statistical analysis of costs**
Not stated.

**Indirect Costs**
Not assessed.
Currency
US dollars ($).

Sensitivity analysis
A one-way and a multi-way sensitivity analysis were performed due to the variability in the data. The interquartile range and the overall effect of changes in the variables on the CE ratio was stated.

Estimated benefits used in the economic analysis
Public access defibrillation by lay responders increased QALYs from 0.25 to 0.28. Public access defibrillation by police increased QALYs from 0.25 to 0.37.

Cost results
Public access defibrillation by lay responders increased total costs ($5,900 versus $7,100). For public access defibrillation by police, total costs increased from $5,900 to $9,200. The discount rate was assumed to be 3% for all costs.

Synthesis of costs and benefits
Estimated costs and benefits were combined in CE ratios: cost/QALY at 3% for costs. An incremental analysis was performed. Public access defibrillation by lay responders and by police yielded a CE ratio of $44,000 per QALY gained and $27,200 per QALY gained, respectively. The cost-effectiveness of public access defibrillation was sensitive to single or simultaneous changes in survival rates, the costs of the defibrillation programme or hospitalisation.

Authors' conclusions
Implementation of PAD is potentially associated with an incremental cost-effectiveness ratio similar to other common medical interventions. A randomised controlled trial is necessary to evaluate the effectiveness and cost-effectiveness of the use of defibrillation in sudden cardiac arrest.

CRD COMMENTARY - Selection of comparators
The reason for the choice of the comparator is clear.

Validity of estimate of measure of benefit
The values for some benefit measures were extracted from single studies. There is not enough information in the paper to justify such a selective approach. Moreover, these studies were sometimes nonexperimental.

Validity of estimate of costs
Cost estimates were based on observations and expert opinion. This substantially limits the generalisability of the results to other settings. An extensive sensitivity analysis was performed to account for this drawback of the study. However, incremental CE ratios were found to be sensitive to changes in cost figures. This confirms the limited generalisability of the results.

Other issues
The authors relied on published data from several sources. Hence, the estimates may be confounded by information that was not incorporated in the model. The model has made simplifying assumptions. In particular, the fact that variables were modelled with a certain distribution, because the true value of the variables was unknown, artificially enlarges confidence intervals for CE ratios.
Implications of the study
Before wide acceptance of PAD, the analysis should be revised to reflect better estimates of the true effectiveness and costs of the programmes. An economic evaluation of a randomised controlled trial is called for.

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