Cost-effectiveness analysis of a rural/urban first-responder defibrillation 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
A rural first-responder defibrillation programme for patients with cardiac disease (ventricular fibrillation (VF)).

Type of intervention
Treatment and secondary prevention.

Economic study type
Cost-effectiveness analysis.

Study population
Rural and urban patients with cardiac disease (ventricular fibrillation).

Setting
Hospital and community. The economic analysis was carried out in Waterloo, Ontario, Canada.

Dates to which data relate
Effectiveness data were based on studies published between 1984 and 1999. The price year appears to have been 1996.

Source of effectiveness data
The evidence for the final outcomes was based on a literature review.

Outcomes assessed in the review
The outcomes assessed were the annual rate of prehospital cardiac arrest, the proportion of all cardiac arrests being in VF, the response interval, and the incremental survival from VF.

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
5 studies were included in the review.

Methods of combining primary studies
Most of the input values were derived from individual studies.

Investigation of differences between primary studies
Not reported.

Results of the review
The annual rate of prehospital cardiac arrest has been found to be 0.5 to 0.77 per 1,000 population and a conservative estimate of 0.5 was adopted in this study. An estimate of 50% of all cardiac arrests was assumed to be in VF and this level approximates to a median response interval of 8 minutes. One study of the city of Waterloo indicated that the fire department could arrive on scene in 8 minutes or less 91.3% of the time. The same response interval was considered to be reasonable for a rural area. A conservative estimate of 6% incremental survival from VF for both areas was used.

Measure of benefits used in the economic analysis
The number of lives saved per year was the measure of benefit. The analysis was conducted on the city of Waterloo (population 80,000 over 25 square miles) and the adjoining rural township of Wellesley (population 8,000 over 105 square miles).

Direct costs
Costs were discounted with the time frame of the cost analysis being 6 years. Some resource use quantities were reported separately from the costs and cost items were reported separately. The cost analysis covered the costs of defibrillators, ancillary equipment, training equipment, trainer/provider certification (each of the two communities had approximately 60-70 providers requiring training), biomedical services, and call review. The perspective adopted in the cost analysis was not explicitly specified. The price year appears to have been 1996. Training costs for providers were excluded since the training time was being absorbed into the yearly allotment of training. Similarly, no other operational costs such as vehicles, fuel, or wages were included since these departments were already established and responding to these types of calls (cardiac arrests).

Indirect Costs
Indirect costs were not included.

Currency
Canadian dollars (Can$).

Sensitivity analysis
A one-way sensitivity analysis was performed by varying the survival rate.

Estimated benefits used in the economic analysis
The number of lives expected to be saved per year was 0.04 in the rural area versus 0.4 in the urban area.
Cost results
The discount rate was 5%. The total cost for the rural defibrillation programme was $35,178 versus $48,225 for the urban defibrillation programme.

Synthesis of costs and benefits
The cost per life saved was Can$6,776 for the urban defibrillation programme versus Can$49,274 for the rural defibrillation programme. The sensitivity analysis showed that even the worst-case save rate for the urban centre (2%; $20,328) was significantly less than the best-case save rate (10%; $29,546) for the rural area.

Authors’ conclusions
The cost per life saved for a rural defibrillation programme is significantly more expensive than one for an urban centre. However, the cost per life saved is still economical compared with other common treatments for life-threatening illnesses.

CRD COMMENTARY - Selection of comparators
A justification was given for the choice of the comparator. It was the conventional method in the context in question. You, as a database user, should consider whether this is a widely used health technology in your own setting.

Validity of estimate of measure of effectiveness
The internal validity of the effectiveness results cannot be guaranteed given the lack of evidence of a systematic approach in the literature review, and the absence of any description of how primary studies were critically appraised for inclusion in the review. As acknowledged by the authors, their analysis was based on projected estimates, which were further varied in the sensitivity analyses. Further details of the methods used to derive these estimates or ranges would have been useful.

Validity of estimate of measure of benefit
The estimation of benefits was obtained directly from the effectiveness analysis. This choice of estimate appears to be justified.

Validity of estimate of costs
Some resource use quantities were reported separately from the costs and the price year was specified. However, the details of the resource consumption profile were not given, adequate details of methods of cost estimation were not given (such as the sources of the cost data) and the perspective adopted in the cost analysis was not specified. It is not clear whether the cost data were based on true costs or charge/reimbursement data: it was only reported that the cost data did not include tax. The effects of alternative procedures on indirect costs were not addressed, statistical analyses were not performed on resource use or cost data and the robustness of the cost results was not investigated through sensitivity analysis. The cost results may not be generalisable to other countries.

Other issues
The authors’ conclusion may be open to question given the lack of a comprehensive literature review, the limitations of the cost analysis and the absence of extensive sensitivity analyses. The issue of generalisability to other settings was not addressed, although appropriate comparisons were made with other studies. According to the authors it could be argued that the estimates do not accurately reflect the incremental benefit of having first-responder defibrillation. For instance, the ambulance services already provide defibrillation so there could be some measure of savings in both the urban and rural areas (historically none in the township). Erosion of skills from infrequent practice and the need for continuing education and training are also concerns in small rural programmes.
Implications of the study
Any community contemplating a first-responder defibrillation programme should conduct a realistic appraisal of the frequency of use, expected success, and the associated costs. Further research needs to be done in this area to determine the actual outcomes of rural defibrillation programmes and further to define the impact of a variety of variables.

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