Improved out-of-hospital cardiac arrest survival through the inexpensive optimization of an existing defibrillation program: OPALS Study Phase II


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 rapid defibrillation programme (defined as arriving at the scene with a defibrillator within 8 minutes of receiving the emergency call) in a large multi-centre emergency medical services (EMS) system with existing basic life support and defibrillation (BLS-D) level of care for improving cardiac arrest survival. Some of the rapid defibrillation strategies employed were: ambulance base paging, mobile deployment of ambulances, implementation of new provincial dispatch guidelines, tiered response agreements with fire departments, continuous quality improvement for response intervals and introduction of defibrillation performed by fire-fighters.

Type of intervention
Treatment (emergency medical services (EMS) management).

Economic study type
Cost-effectiveness analysis.

Study population
All patients who had out-of-hospital cardiac arrest in communities and for whom resuscitation was attempted by emergency responders.

Setting
Community and emergency medical services. The present study represents Phase II of the Ontario Pre-hospital Advanced Life Support (OPALS) study, which deals with 19 urban and suburban Ontario communities. The economic study was conducted in Ontario, Canada.

Dates to which data relate
Effectiveness data for Phase I of the study, before the implementation of the rapid defibrillation programme, were collected between 1 January 1991 and 31 December 1995. Effectiveness data for Phase II of the OPALS study, after implementation of the rapid defibrillation programme, were collected between 1 July 1994, and 31 March 1997. Resource use data were not stated. The price year was not explicitly specified.

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

Link between effectiveness and cost data
Costing was retrospectively undertaken on the same patient sample as that used in the effectiveness analysis.
Study sample
Power calculations relating to the sample size were performed. A minimum of 3,600 patients in phase I and 1,200 in phase II was required to detect a relative difference in survival of 50% from phase I to phase II based on alpha of 0.05, beta of 0.20, baseline survival of 4.0%, and a 3:1 ratio of phase I to phase II to minimise duration of phase II. 4,690 consecutive patients were enrolled in Phase I of the study with a mean (SD) age of 68.1 (13.9) and 1,641 consecutive patients in Phase II with a mean (SD) age of 69 (13.7). Excluded patients were those younger than 16 years, those who had trauma, or whose arrests were clearly of non-cardiac aetiology.

Study design
The study was a non-randomized trial with historical controls comparing survival 36 months before (phase I) and 12 months after (phase II) system optimisation. The study was carried out in 19 urban and suburban communities (populations ranging from 16,000 to 750,000). One additional eligible community was excluded from the study because it did not meet the rapid response criteria. Loss to follow-up was not reported. The study interventions were overseen through a central advisory committee. Patient and dispatch data relied on centralised and standardised record keeping systems.

Analysis of effectiveness
The principle (intention to treat or treatment completers only) used in the analysis of effectiveness was not explicitly specified. The main health outcome measure used in the analysis was the survival rate to hospital discharge and, as a result, the number of additional lives saved each year. Only phase II patients were followed-up at 1 year to determine survival, neurological function according to a 5-point scale of Cerebral Performance Category and quality of life by means of Health Utility Index. Other survival measures were collected according to Utstein style, such as return of spontaneous circulation and admission to a hospital. Patients in both phases had similar clinical and demographic characteristics. Logistic regression analysis was performed to control for potential confounding variables.

Effectiveness results
The proportion of cases meeting the 8-minute response criterion increased from 76.7% to 92.5% (p<.001). Overall survival to hospital discharge improved from 3.9% to 5.2% (p = 0.03). The 33% increase in survival represents 21 additional lives saved each year in the study communities (approx. 1 life per 120,000 residents). Based on functional and global health criteria, the quality of life of the survivors was reported to be very good.

Clinical conclusions
Rapid defibrillation strategies (ambulance base paging, mobile deployment of ambulances, implementation of new provincial dispatch guidelines, tiered response agreements with fire departments, continuous quality improvement for response intervals and introduction of defibrillation performed by fire-fighters) can lead to significant improvements in survival after non-hospital cardiac arrest.

Measure of benefits used in the economic analysis
The benefit measure was number of additional lives saved each year in the study communities.

Direct costs
Costs were not discounted. Quantities were not reported separately from the costs. A crude estimate of programme costs was performed, considering the initial charges for implementing the defibrillation programme (equipment, training fire-fighters in defibrillation techniques, administration costs for the Ministry of Health for policy revisions) and the ongoing annual charges for continuing the programme (equipment maintenance and medical quality assurance). Charge data were used as opposed to true costs. The date of the price data was not explicitly specified.
Not considered.

**Currency**
US dollars ($).

**Sensitivity analysis**
Not conducted.

**Estimated benefits used in the economic analysis**
Overall survival to hospital discharge improved from 3.9% to 5.2% (p = 0.03). The 33% increase in survival represents 21 additional lives saved each year in the study communities (approx. 1 life per 120,000 residents).

**Cost results**
The initial charges for implementing the defibrillation programme were estimated to be $980,000 and the ongoing annual charge for continuing the programme was $50,000.

**Synthesis of costs and benefits**
The charges were estimated to be $46,900 per life saved for establishing the rapid defibrillation programme and $2,400 per life saved annually for maintaining the programme.

**Authors' conclusions**
An inexpensive, multifaceted system optimisation approach to rapid defibrillation can lead to significant improvements in survival after cardiac arrest in a large BLS-D EMS system.

**CRD COMMENTARY - Selection of comparators**
The reason for the choice of the comparators (the system before the introduction of rapid defibrillation programme) is clear.

**Validity of estimate of measure of benefit**
The estimate of benefit is likely to be internally valid in view of the fact that the study findings were based on a large sample size, a strong controlled study design, and rigorous data collection and analysis methodology.

**Validity of estimate of costs**
Quantities were not reported separately from the costs. Adequate details of methods of cost estimation were not given. A crude estimate of programme costs was performed. Cost results may not be generalisable to other settings or countries.

**Other issues**
The authors' conclusion appears justified despite the lack of a systematic cost and sensitivity analysis. The study results were deemed generalisable to most North American and European communities with population of less than 1 million, and appropriate comparisons were made with other studies.

**Implications of the study**
The authors believed that the study findings have important health policy implications for communities that wish to
improve their response to cardiac arrest. Every effort should be made to optimise defibrillation response intervals by improving dispatch methods, better deployment of existing EMS vehicles, and use of first responder defibrillation.

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