Cost-effectiveness analysis of telemedical devices for pre-clinical traffic accident emergency rescue in Germany

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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
The authors studied two versions of telemedical devices, an automatic accident alert version and a full equipment version. The automatic alert version comprised an automatic real-time message to the Public Service Answering Point that included details of the time of the accident, exact location, vehicle identification, and the number and severity of injured persons. The full equipment version consisted of all these elements but added a "telemedicine for laypersons component", with a mobile device with touch-screen display, audio and video connection, camera and medical diagnosis equipment. These additions enable emergency physicians in a telemedical centre to instruct and support laypersons at the scene of an accident.

Type of intervention
Diagnosis and treatment.

Economic study type
Cost-effectiveness analysis.

Study population
The hypothetical study population comprised individuals involved in road traffic accidents.

Setting
The setting was the community (lay individuals offering roadside assistance to accident victims). The economic study was carried out in Germany.

Dates to which data relate
The effectiveness data were collected from studies and reports published between 1995 and 2006. The cost data were obtained from publicly available official and administrative statistics, studies, special evaluations and databases, and related to 2002.

Source of effectiveness data
The effectiveness data were derived from a review and synthesis of published studies, supplemented with some authors' assumptions.

Modelling
No modelling was reported. However, the authors reported that a logistic regression analysis was conducted to determine significant relationships between age-square, Injury Severity Score, Glasgow Coma Scale and first-aid measures by laypersons on survival (measured as reduced deaths).
Outcomes assessed in the review
The outcomes assessed in the review were the probability of a layperson's help, the reduction in death, and the reduction in severely injured persons for both automatic accident alert and full equipment.

Study designs and other criteria for inclusion in the review
The authors carried out a systematic review of the literature to ascertain that a reduction in the therapy-free interval (i.e. between the accident and medical help arriving) due to telemedical devices reduces death rates and improves medical outcomes for victims. The authors did not, however, report the study designs and criteria for inclusion in their review. They seem to have selected studies that reported relevant data.

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
It appears that the validity of the primary studies has not been assessed.

Number of primary studies included
Four studies were included in the review of effectiveness data.

Methods of combining primary studies
Data from the primary studies were combined using narrative methods and regression analysis.

Investigation of differences between primary studies
The authors discussed some differences between the studies and noted reasons, such as country-specific factors, for their existence.

Results of the review
The probability of a layperson's help was 87%.

Using the logistic model, the number of deaths was estimated to be reduced by around 3.65% with automatic accident alert and by 9% with full equipment.

The reduction in deaths was 201 with automatic accident alert and 734 with full equipment.

The reduction in severely injured persons was 5,417 with automatic accident alert and 12,027 with full equipment.

Methods used to derive estimates of effectiveness
The authors made an assumption to support their analysis.

Estimates of effectiveness and key assumptions
The authors assumed 100% market penetration of the technologies.
Measure of benefits used in the economic analysis
The summary measure of health benefits was the number of life-years gained (LYG). The LYG within a time frame of 10 years were calculated based on the records of 1,244 traffic accidents occurring between 1999 and 2003 from the GIDAS database and the average life expectancy of killed accident victims.

Direct costs
The costs were estimated from a societal perspective. The analysis encompassed the costs of the telemedical equipment, costs resulting from personal injury from traffic accidents (e.g. hospital admission, emergency medical services, remedy, rehabilitation) and administration (police, lawsuits and insurance). The cost of equipment was derived from estimated sales volume. Personal injury costs were derived from the BASi Federal Highway Research Institute. The costs were estimated over a 10-year horizon and were discounted at a rate of 5%, 2002 being used as the reference year.

Statistical analysis of costs
The costs were treated deterministically.

Indirect Costs
Indirect costs due to productivity losses were included. They represented potential savings in the structural costs of the rescue services (e.g. from reducing the number of unnecessary personnel at the scene) and were taken from published sources. The costs were estimated over a 10-year horizon and were discounted at a rate of 5%, 2002 being used as the reference year.

Currency
Euros (EUR).

Sensitivity analysis
Multi-way sensitivity analyses were carried out to explore the impact of uncertainty in the data and to check the validity of the results. Best- and worst-case scenarios were estimated using data from published sources.

Estimated benefits used in the economic analysis
The number of LYG was 7,448 for automatic accident alert and 27,291 for full equipment.

Cost results
The costs related to the first year of implementation. The system costs were EUR 1,657,920,000 for automatic accident alert and EUR 5,569,300,000 for full equipment.

Cost-savings due to death were EUR 22,164,411 for automatic accident alert and EUR 80,982,802 for full equipment.

Cost-savings due to severe injury were EUR 43,532,637 for automatic accident alert and EUR 96,650,169 for full equipment.

Cost-savings due to wasted journeys were EUR 283,662 for automatic accident alert and full equipment.

Cost-savings due to erroneous dispatching were EUR 1,167,779 for both automatic accident alert and full equipment.

Synthesis of costs and benefits
The present value of the cost per LYG after 10 years was EUR 247,977 for automatic accident alert and EUR 239,524 for full equipment, compared with the status quo situation. In the best- and worst-case scenarios, automatic alert was the
most cost-effective alternative.

**Authors’ conclusions**

Although telemedical devices may considerably reduce the numbers of people killed and severely injured in traffic accidents, the devices are associated with high cost-effectiveness ratios.

**CRD COMMENTARY - Selection of comparators**

The authors compared two forms of telemedical device with the status quo of not using telemedical devices for roadside assistance at accident scenes. The authors discussed the possibility of alternative comparators, but noted that data of effectiveness is either not available or is treated as confidential by the automobile industry.

**Validity of estimate of measure of effectiveness**

The authors reported carrying out a systematic review to ascertain effectiveness data. However, they provided few details about this review in terms of the sources searched and the criteria used to ensure the validity of the data used. The authors noted in their discussion that the use of official statistics, as well as some of their calculations to combine the data, might lead to some uncertainty in the results. Official sources were used where possible. Future work might consider study designs that further improve the reliability of the data, for instance, a randomised trial of individuals asked to use a telemedical device in their car over a period of time.

**Validity of estimate of measure of benefit**

The number of LYG was used as a summary measure of health benefits. It was estimated directly from the effectiveness study. The measure enables broad comparisons with other technologies.

**Validity of estimate of costs**

The analysis aimed to estimate the costs from a societal perspective, and all the costs relevant to this perspective were included. Most importantly, the authors used sources that included an estimate of lost earnings due to reduced productivity from injured persons. The analysis also encompassed the costs and savings to the medical services and the cost of the telemedical devices. The authors might have split the cost estimates according to year to show how the costs changed over time. For instance, the reader might expect the principle costs to be incurred in the first year, as was indicated, and that there may be maintenance or replacement costs for the technology. Sensitivity analyses showed that the automatic alert was most cost-effective for the best- and worst-case scenarios, but that the full equipment technology was most cost-effective for the baseline estimates; further discussion exploring the reason for this difference would have been useful. Since the costs were incurred during a 10-year horizon, all future costs were appropriately discounted. The price year was reported, which will aid any future inflation exercises. Prices were not adjusted for inflation in the base-case analysis, but a 1.5% inflation rate was used in the best-case scenario.

**Other issues**

Some comparisons with other work were carried out, but the authors noted a lack of data in this area as a barrier to comparisons. The issue of generalisation was considered with differences between the USA and Germany being discussed. The results were presented clearly and were easy to understand, and the conclusions were an accurately reflection of both the scope of the study and the results presented. However, the authors might have considered the analysis from different perspectives. If the individual car driver incurred the cost of the technology purchase they would not be interested in cost-savings to the emergency service providers. Subsidies might be needed to encourage uptake and these might be financed by those receiving the cost-savings. Issues such as these might have been discussed more.

**Implications of the study**

The authors discussed the potential benefits of a coordinated European initiative among European member states.
Source of funding
None stated.

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Other publications of related interest

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