Cost-effectiveness of interventions to reduce the thrombolytic delay for acute myocardial infarction

Kildemoes H W, Kristiansen I S

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 health technology assessed was a public awareness campaign aimed at shortening the delay for thrombolytic therapy in acute myocardial infarction (AMI), both alone and in combination with pre-hospital diagnosis through telemedicine.

Type of intervention
Secondary prevention.

Economic study type
Cost-effectiveness analysis.

Study population
The population comprised Danish AMI patients. No inclusion or exclusion criteria were specified.

Setting
The setting was secondary care. The economic study was carried out in Denmark.

Dates to which data relate
The effectiveness data were derived from studies published between 1987 and 1998 and an unpublished study from 2000. The costs related to data from 1987. The price year was 1999.

Source of effectiveness data
The effectiveness data were derived from a review of the literature.

Modelling
Modelling was used to adapt Swedish data on reduction in delays from a public campaign, to the Danish AMI population. The health benefits were estimated in terms of increased AMI survival during the first month after infarction as a result of earlier thrombolytic treatment, assuming that the beneficial effects diminish as a nonlinear function of the time from onset of symptoms to start of therapy. The additional health benefit of combining pre-hospital telemedicine diagnostics in reducing door-to-needle delays for patients admitted by ambulance was also modelled. A 5-year time horizon was modelled. The exact details of the model were not reported extensively.

Outcomes assessed in the review
The outcomes assessed in the review were:
the percentage of current delays by intervals of 60 minutes;
the percentage of delays after a campaign by intervals of 60 minutes;
the percentage of thrombolytic therapies by intervals of 60 minutes;
mortality reduction due to thrombolytic therapy as a function of delay;
the occurrence of AMI in Denmark;
the effect of pre-hospital telemedicine diagnosis; and
life expectancy after the first month after AMI.

Study designs and other criteria for inclusion in the review
Not reported.

Sources searched to identify primary studies
MEDLINE was searched for primary studies.

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
Approximately nine primary studies were included in the review.

Methods of combining primary studies
The primary studies do not appear to have been combined.

Investigation of differences between primary studies
The differences between the primary studies were not reported and were not investigated.

Results of the review
In Denmark, 34% of patients with AMI arrive at hospital within 2 hours after the onset of symptoms and 81% arrive within 12 hours. Seven per cent are admitted within 1 hour after the onset of symptoms. Door-to-needle delay was 60 minutes. Presentation delay was presented in full in the paper, for hourly increments over a 24-hour period.

Twenty-one per cent of patients older than 65 years and 8% of those older than 75 years have thrombolytic therapy.

The additional benefit of combining pre-hospital telemedicine diagnostics with a public campaign reduced door-to-needle delay by 50%.

Thirty-two per cent of patients with suspected AMI call the emergency phone number and are transported by ambulance, while 64% contact a general practitioner. Of the latter, 80% are transferred by ambulance to hospital.
The estimated loss of benefit is 1.6 lives per 1,000 for each hour of delay.

The initial mortality reduction was estimated at 35 per 1,000 treated patients compared with no thrombolysis.

**Measure of benefits used in the economic analysis**
The summary measure of benefit used was the life-years gained (LYG).

**Direct costs**
The direct costs were taken directly from Swedish cost data. No breakdown of the unit cost and resources was provided. The Swedish costs were published in dollars and were then converted to Danish kroner. They were also adjusted for different size of population and inflation in Denmark between 1987 and 1999. The Danish costs were discounted at a rate of 5%.

**Statistical analysis of costs**
No statistical analysis of the costs was carried out.

**Indirect Costs**
The indirect costs were not included.

**Currency**
Danish kroner (DKK). The conversion rate was DKK 100 = $684.36 in 1987.

**Sensitivity analysis**
Each of the assumptions outlined below was varied in the one-way sensitivity analysis, and the consequences were compared:

the costs were computed assuming 25% of the patients with non-cardiac chest pain in the emergency department would be admitted to the cardiology department;

the effect of a reduction in the cost of information material and the effect of a reduction in the proportion of those treated with thrombolysis (33.5% instead of 41.8%);

the effect of having more elderly and fewer younger patients treated;

the relationship between delay and mortality reduction is linear (rather than non-linear);

capital equipment in the cost analysis was considered to last for 3 years.

**Estimated benefits used in the economic analysis**
Five years of reduced delay (i.e. running the campaign) would result in 177 LYG from avoided fatalities (discounted at 5%). Five years of telemedicine plus the campaign would result in 511 LYG. The marginal number of LYG would therefore be 337.

**Cost results**
The estimated net 5-year cost of the public campaign (intervention cost minus savings) would be DKK 51.3 million (50.2 million after discounting).

The estimated cost of the campaign was DKK 51.3 million (50.2 million after discounting).
The estimated cost of pre-hospital telemedicine diagnostics was DKK 304.8 million (285.5 million after discounting at 5%).

Synthesis of costs and benefits

The costs and benefits were combined by calculating the cost per LYG.

The cost of the public campaign per LYG was DKK 161,459 (283,304 after discounting both life years and costs).

If the public campaign was combined with pre-hospital telemedicine diagnostics, the cost per LYG would be DKK 321,440 (DKK 563,771 after discounting).

The marginal cost per LYG of adding the telemedicine strategy to the public campaign was DKK 854,700 (discounted).

In the sensitivity analysis, assuming that 25% patients with non-cardiac chest pain in the emergency department would be admitted to the cardiology department, the cost per LYG would increase by 103% to DKK 577,000.

With a reduction in the cost of information material from DKK 40 million to DKK 20 million, the cost per LYG decreased by 40% to DKK 170,000.

When assuming a different age distribution among those having thrombolysis (more elderly treated), the cost per LYG was DKK 346,000.

Realistic changes in other parameters were reported to have little influence on the cost-effectiveness ratio.

Authors' conclusions

The authors concluded "programmes aimed at reducing delay of thrombolysis in patients with AMI (acute myocardial infarction) are likely to have a limited impact on AMI fatality. Information campaigns may have acceptable ratios, while telemedicine programmes lead to threefold greater ratios. Whether such programmes can be considered cost-effective will depend upon how life year gains are valued by society".

CRD COMMENTARY - Selection of comparators

The reason for the choice of the comparator was clear. The comparator was chosen as it represented the current situation with regards to thrombolytic delay in Denmark. You should consider if this pertains to the situation in your own setting

Validity of estimate of measure of effectiveness

The search methodology, although reported, does not appear to have been extensive since only one database was reviewed. However, the authors provided search terms which would enable the searches to be repeated using a wider variety of sources. Whilst the use of Swedish data in the Danish setting was justified, it was unclear whether all the available evidence had been identified, therefore it is not possible to be sure that the best available evidence has been used to model the scenario. It was clear, however, that a systematic review was not undertaken. The authors carried out a number of sensitivity analyses relating to the efficiency estimates. These approaches improved both the internal validity and generalisability of the study. However, overall, the internal validity is likely to be low.

Validity of estimate of measure of benefit

The authors used LYG as their benefit measure, which enhances the ability to compare the results of their study with those of other health care programmes. However, the method of modelling this benefit measure was not reported in extensive detail. The authors highlighted the limitations of modelling thrombolytic therapy as a discrete function of time rather than as a continuous function of time.
Validity of estimate of costs
The perspective adopted was clear. The authors reported details of the methods used for transforming Swedish cost data directly into Danish cost data, but no breakdown of the cost components included was provided. The price year was stated and discounting was performed appropriately. In addition, some costs were subjected to sensitivity testing. However, the above limitations imply that the cost results should be treated with some caution. More detailed reporting of the cost components would be required to fully assess whether all the relevant costs had been included.

Other issues
The authors made appropriate comparisons of their findings with those from other studies. The issue of generalisability to other settings was not addressed. The authors do not appear to have presented their results selectively. The authors reported a number of further limitations of their research, which were related to the quality of the studies used for estimating the costs and effectiveness of the intervention.

Implications of the study
The present study gave no unequivocal answer to the question of whether public campaigns should be implemented, because there is no official threshold value for how much society is willing to pay for gaining a life-year. The authors suggested that the campaign may also reduce out-of-hospital AMI deaths. Nurses and doctors must be prepared to handle the increased demand for health care before starting the programme.

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