Cost-effectiveness of two models of management for patients on chronic warfarin therapy: a Markov model analysis

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 study evaluated two models of management for patients on chronic warfarin therapy, the anticoagulation clinic (AC) versus routine medical care (RMC). The patients' general practitioners provided RMC, whereas physicians manned the ACs and monitored effects more closely.

Type of intervention

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised a hypothetical cohort of patients receiving chronic warfarin therapy.

Setting
The setting was primary and secondary care. The economic study was carried out in Hong Kong.

Dates to which data relate
The effectiveness data were derived from studies published between 1982 and 2003. The resource use data were gathered from January 1999 to June 2001. The price year was not reported.

Source of effectiveness data
The effectiveness data were derived from a review of completed studies and authors' opinions.

Modelling
A Markov model was constructed to estimate the clinical and economic outcomes associated with AC and RMC, which represented the two main branches of the tree. Four health events were considered in the model. These were major bleeding, fatal bleeding, major thromboembolic event (TE) and fatal TE. Minor events were not considered because they did not require medical attention. The model had a time horizon of 10 years with yearly cycles.

Outcomes assessed in the review
The outcomes assessed in the review were the annual transition probabilities of major bleeding, major TE, fatal bleeding and fatal TE. The hazard ratio of recurrent bleeding after a bleeding event, and of recurrent TE after a TE, were also estimated from the literature.
Study designs and other criteria for inclusion in the review
Primary studies were included in the review if they were reports written in the English language. The inclusion criteria also specified that the patients in the trials were aged at least 18 years and warfarin therapy was prescribed for at least 3 months. A further criterion was that the occurrence of major and fatal events had to be reported separately. The authors stated that only one study was a randomised clinical trial. The remaining studies were observational (13 retrospective and only 2 prospective).

Sources searched to identify primary studies
MEDLINE was searched between 1984 and 2003 using the keywords "warfarin", "bleeding" and "thromboembolism".

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
Sixteen primary studies were included in the review.

Methods of combining primary studies
The authors stated that results were pooled but they did not explain how.

Investigation of differences between primary studies
Not stated.

Results of the review
The probability values for AC were 0.035 (range: 0 - 0.123) for major bleeding, 0.022 (range: 0 - 0.067) for major TE, 0.003 (range: 0 - 0.008) for fatal bleeding and 0.002 (range: 0 - 0.010) for fatal TE.

The probability values for RMC were 0.046 (range: 0.018 - 0.164) for major bleeding, 0.064 (range: 0.044 - 0.300) for major TE, 0.007 (range: 0.003 - 0.011) for fatal bleeding and 0.007 (range: 0.004 - 0.019) for fatal TE.

The hazard ratio was 2.90 (range: 1 - 5) for recurrent bleeding after a bleeding event, and 1.67 (range: 1 - 5) for recurrent TE after a TE.

Methods used to derive estimates of effectiveness
The authors made some assumptions about the probability of discontinuing warfarin therapy.

Estimates of effectiveness and key assumptions
The probability of discontinuing warfarin therapy was assumed to be 0.5 (range: 0 - 1), both after major bleeding and after a major TE.

Measure of benefits used in the economic analysis
The summary benefit measure used was the total number of events per 100 patient-years. This was derived from the decision model. The results were reported for each of the major events considered in the analysis. No discount rate was
reported.

**Direct costs**
The health service costs were included. The categories of costs considered in the analysis were medications, laboratory and diagnostic tests, clinic visits, emergency room visits, hospitalisation and surgery. The costs were estimated from charges of itemised services of public hospitals posted in the Hong Kong Gazette. Resource use was estimated from actual data, which referred to a sample of patients admitted to a Hong Kong public hospital from January 1999 to June 2001. Discounting was relevant since the time horizon of the model was 10 years. However, no discount rate was reported. Broad cost estimates of health events were reported whereas resource use, determined by the model, was not. The price year was not reported.

**Statistical analysis of costs**
No statistical tests of the costs were performed.

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

**Currency**
US dollars ($).

**Sensitivity analysis**
One-way sensitivity analyses were carried out to test the robustness of the estimated costs and benefits of the two alternative strategies. All model inputs were varied within the ranges published in the literature or assumed by the authors.

**Estimated benefits used in the economic analysis**
There were 4.6 major bleeding events per 100 patient-years with AC and 5.8 with RMC.

There were 1.5 fatal bleeding events per 100 patient-years with AC and 3.2 with RMC.

There were 2.4 major TE events per 100 patient-years with AC and 7.2 with RMC.

There was 1 fatal TE per 100 patient-years with AC and 3.1 with RMC.

In total, there were 9.5 events per 100 patient-years with AC and 19.3 with RMC. The difference of 9.9 events (51%) favoured the AC strategy.

**Cost results**
The cost per patient-year was $840 with AC and $1,179 with RMC. The cost-difference of $339 (29%) favoured the AC option.

**Synthesis of costs and benefits**
The costs and benefits were not combined because the incremental analysis showed that the AC strategy dominated the RMC option, with the former being both more effective and less costly. The sensitivity analysis suggested that the results were sensitive to variations in the probability of major bleeding in the AC group. When the value was above the threshold value of 0.10, then the number of total events per 100 patient-years and total costs would be greater than those of the RMC group.
Authors' conclusions
From the perspective of the public health organisation in Hong Kong, coordinated care provided by anticoagulation clinics (ACs) was more cost-effective than routine medical care (RMC) for the management of patients on chronic warfarin therapy.

CRD COMMENTARY - Selection of comparators
The rationale for the choice of the comparators was clear. The authors justified the selection of RMC as the standard strategy for the management of chronic warfarin therapy. Care delivered by ACs represented a new approach. You should decide whether they are valid comparators in your own setting.

Validity of estimate of measure of effectiveness
The effectiveness measures used in the analysis came from a review of the literature, which appears to have been systematic. The selection criteria for inclusion in the review were reported, as was the method used to conduct the search. However, it was not stated how the primary estimates were combined. The authors reported the design of the primary studies. They acknowledged that most of the studies had limited internal validity, as the bulk of the evidence came from retrospective observational studies. The authors also made some assumptions that were used in the decision model. Uncertainty around the estimates was investigated in the sensitivity analyses where all model inputs were varied.

Validity of estimate of measure of benefit
The summary benefit measure was related to the interventions under evaluation. It is not comparable with the benefits of other health care interventions. The model used to derive the benefit measure appears to have been appropriate.

Validity of estimate of costs
The authors stated explicitly which perspective was adopted in the study and provided a breakdown of the cost items. However, information on the quantities of resources used was not provided. The price year was not given. The source of the data on the costs and quantities was provided. The costs were treated deterministically, although sensitivity analyses were performed on all economic inputs.

Other issues
The authors did not compare their findings with those from other studies. They also did not address the issue of the transferability of the study results to other settings. It was stated that the decision model could be adopted by other health care systems using local estimates in order to replicate the study in other settings. The authors noted some limitations of their analysis. These mainly relate to the use of retrospective data and the exclusion of long-term costs associated with nursing home care.

Implications of the study
The study results suggested that coordinated care provided by ACs represented a cost-effective strategy for the management of patients on chronic warfarin therapy.

Source of funding
Supported by the School of Pharmacy, Chinese University of Hong Kong.

Bibliographic details