An evidence-based cost-effectiveness model on methods of prevention of posttraumatic venous thromboembolism
Velmahos G C, Oh Y, McCombs J, Oder D

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
Various methods of prophylaxis to prevent venous thromboembolism (VTE) were examined. The three methods were low-dose heparin (LDH), low molecular weight heparin (LMWH) and sequential compression devices (SCDs).

Type of intervention
Prophylaxis.

Economic study type
Cost-effectiveness analysis.

Study population
The study population consisted of trauma patients who were at high risk of VTE.

Setting
The setting was not unclear, but it is likely to have been community services. The economic study was carried out in Los Angeles (CA), USA.

Dates to which data relate
The dates to which the data related were not reported. The price year was not reported.

Source of effectiveness data
The effectiveness data were gathered from a published evidence-based report, other relevant literature and the authors’ assumptions.

Modelling
A decision tree model was developed on the basis of the probabilities of various outcomes after VTE. In particular, adverse drug reaction to prophylaxis (ADRp), deep venous thrombosis (DVT), adverse drug reaction to treatment for VTE (ADRt), pulmonary embolism (PE), adverse drug reaction to treatment for pulmonary embolism (ADRpe), and death. The lifetime period of observation was used.

Outcomes assessed in the review
The outcomes assessed in the review and used as model inputs were the incidences of various outcomes (DVT, ADRp, ADRt, ADRpe, PE and death) and the sensitivity of duplex ultrasonography and ventilation-perfusion.
Study designs and other criteria for inclusion in the review
Not stated.

Sources searched to identify primary studies
Not stated.

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
Not stated.

Methods of combining primary studies
The authors assessed the outcomes from a meta-analysis in an evidence-based report (see Other Publications of Related Interest) and added data from existing literature as necessary.

Investigation of differences between primary studies
Not stated.

Results of the review
The incidence of DVT in patients with and without prophylaxis was 12% (range: 10 - 13).

The incidence after ADRp was the same for both LDH and LMWH (3%, range: 2 - 4).

The sensitivity of duplex ultrasonography was 80%.

The incidence of ADRt (with full heparinisation) was 11%.

The incidence of PE (after a false-negative duplex scan) was 3%. The authors used the high end of the 95% confidence interval (1 - 3%) reported in the evidence-based report.

The incidence of fatal PE among patients who had unrecognised, and therefore untreated DVT, was 30%.

The incidence of false-negative ventilation-perfusion scans was 14%.

The incidence of death among patients with missed diagnosis of PE (false-negative ventilation-perfusion scan) was 25%.

The incidence of ADRpe was 11%.

The incidence of adverse reactions among those who had contraindication to heparin (20% of patients with PE) and received vena canal filter was 0%.

"Breakthrough" PE was given a probability of less than 1% and was eliminated from the refined model.
Methods used to derive estimates of effectiveness
In the absence of reliable data, the authors made an assumption about the incidence of death related to ADRt.

Estimates of effectiveness and key assumptions
The incidence of death related to ADRt was arbitrarily set at 5%.

Measure of benefits used in the economic analysis
The health benefits were measured in terms of the number of lives saved and the number of life-years saved. The life expectancy and discounted years of life (3% rate) from 1996 were reported for a range of ages (20 years to 85 years and over).

Direct costs
The cost/resource boundary of the analysis is likely to have been that of the hospital. The direct costs included were for the drugs and medical services. The cost estimates for the drugs used average wholesale prices. The cost estimates for the medical services were derived from the resource-based value scale of the Health Care Financing Administration, and the lowest price was used. The unit costs and quantities were not reported. The price year was not reported. Discounting was not used.

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

Indirect Costs
No indirect costs were included.

Currency
US dollars ($).

Sensitivity analysis
Different probabilities of DVT (0 to 12%) were considered in the one-way sensitivity analyses.

Estimated benefits used in the economic analysis
The estimated benefits used in the economic analysis (number of lives saved or life-years saved) were not reported separately.

Cost results
Only average cost per patient was reported.

The average cost per patient for prophylaxis was $671 by LMWH, $537 by SC and $430 by LDH.

The cost of no prophylaxis was $415 per patient.

The incremental costs were not reported.

Synthesis of costs and benefits
With an incidence of DVT of 12% in patients with and without prophylaxis, no prophylaxis was the most cost-effective.
When the prophylaxis methods were assumed to reduce the risk of DVT to, for example, 8% (a 4% absolute and 33% relative risk reduction), the cost per life saved was less than $50,000 with LDH, $996,032 with LMWH and less than $464,286 with SC.

Prophylaxis with LDH that resulted in a 10% rate of DVT had a cost per life saved of $103,175.

For a 20-year-old patient, the cost per life-year saved was $3,685 with LDH and $71,712 with LMWH.

If the trauma patient receiving prophylaxis with LDH was aged 60 years, the cost per life-year saved would be $6,489.

**Authors' conclusions**

In the absence of convincing data, no prophylaxis was more cost-effective than low-dose heparin (LDH). LDH that resulted in a rate of deep venous thrombosis (DVT) of at least 10% was more cost-effective than low molecular weight heparin (LMWH) or sequential compression devices (SCDs). Prophylaxis of a 20-year-old trauma patient with LDH was highly cost-effective. Although prophylaxis with LDH would be cost-effective in a 60-year-old trauma patient, prophylaxis became less cost-effective with increasing age.

**CRD COMMENTARY - Selection of comparators**

The reason for the choice of the comparators was clear. The comparators were chosen because these technologies represented the potential alternatives of prophylaxis to prevent VTE in trauma patients, while no prophylaxis represented a natural alternative in the cost-effectiveness analyses. You should consider whether these technologies are widely used technologies in your own setting.

**Validity of estimate of measure of effectiveness**

The method used for the meta-analysis (undertaken in the earlier report) was not satisfactorily reported. It was unclear whether the meta-analysis had been conducted in a systematic way to identify relevant research and minimise biases. The authors acknowledged that the number of studies used in the meta-analysis was small and that measurement bias may, therefore, have been high. The estimates derived from the authors' assumptions were not investigated in a sensitivity analysis.

**Validity of estimate of measure of benefit**

The estimation of the benefits was modelled. The decision tree model used to derive the measure of health benefit was appropriate.

**Validity of estimate of costs**

The perspective adopted was unclear, but it is likely to have been that of the hospital. There were few details on the cost items included in the analysis. Hence, it is unclear whether all the categories of costs were included in the analysis. The unit costs and quantities were not reported. No sensitivity analysis of the quantities and prices was conducted, and this may limit the interpretation of the study findings. Discounting was not undertaken even though the costs were incurred over a lifetime period.

**Other issues**

The issue of generalisability to other settings was not addressed and the authors did not compare their findings with those from other studies. The authors did not precisely state the number of patients included in the model. With the exception of the probabilities of DVT occurrence, the data estimates were not tested in a sensitivity analysis. The authors did not report any further limitations of their study. The estimated benefits were not reported separately. Only a synthesis of the costs and benefits was reported, but this was conducted in a manner that was not easy to interpret.
limits the reliability of the study.

**Implications of the study**
The authors recommend that future studies will need to have sufficient statistical power to test a 2\% absolute/16\% relative risk reduction (from 12 to 10\%) to conclusively answer the question. The authors recommend that the cost-effectiveness must be incorporated as a primary outcome in future studies comparing different methods of VTE prophylaxis.

**Source of funding**
Supported by contract number 290-97-0001 from the Agency for Health Care Policy and Research (now the Agency for Healthcare Research and Quality).

**Bibliographic details**

**PubMedID**
11130489

**Other publications of related interest**


**Indexing Status**
Subject indexing assigned by NLM

**MeSH**
Anticoagulants /administration & dosage /economics /therapeutic use; Bandages /economics; Cost-Benefit Analysis; Decision Trees; Evidence-Based Medicine; Heparin /administration & dosage /economics /therapeutic use; Humans; Models, Econometric; Pulmonary Embolism /economics /etiology /prevention & control; Randomized Controlled Trials as Topic; Research Design; Thrombolytic Therapy /economics; United States; Value of Life; Wounds and Injuries /complications

**AccessionNumber**
22001000134

**Date bibliographic record published**
31/01/2004

**Date abstract record published**
31/01/2004