Cost effectiveness of kinetic therapy in preventing nosocomial lower respiratory tract infections in patients suffering from trauma

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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
Kinetic therapy (KT) was compared with standard intensive care unit (ICU) bed care. KT was defined as the use of a bed that continuously turns 40 degrees or more bilaterally.

Type of intervention
Treatment.

Economic study type
Cost-effectiveness analysis.

Study population
The study population was a hypothetical one. Long-stay patients were being treated in intensive care. Thirty-six per cent of the patients had experienced head trauma.

Setting
The setting was tertiary care. The economic study was carried out in the USA.

Dates to which data relate
The effectiveness data were obtained from a study published in 1990 (Fink et al., see Other Publications of Related Interest) and from other published literature. No details of this other published literature were provided. The hospital charges were converted to costs using Eisenberg's department-specific cost-to-charge ratio guide, published in 1989. The Consumer Price Index was used to appreciate the values to 1999. No further details concerning the dates of the data were provided.

Source of effectiveness data
The effectiveness data were derived from a review of published studies.

Modelling
A model was used to estimate the benefits and costs. A decision tree was constructed using TreeAge decision analysis software. The time horizon of the model does not appear to have been stated. The authors made several assumptions in the analysis. Twenty-five per cent of patients assigned to KT would require changing to a standard ICU bed. Three mutually exclusive outcomes were possible (the probability of developing pneumonia, the probability of developing LRTI, and the probability of no respiratory infection). Also, the economic outcomes were the incremental costs for treating an episode of NP or other LRTI (this included the cost of KT in the KT arm).
Outcomes assessed in the review
The outcomes assessed were the probabilities of being in each health state, and the probabilities of moving from one health state to another. Further details of the outcomes assessed in the review were not given.

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
Three primary studies appear to have been included in the study. No further details of these studies were provided.

Methods of combining primary studies
The authors appear to have been selective in their choice of the data used from each study.

Investigation of differences between primary studies
Differences between the studies were not investigated.

Results of the review
Of those sent for KT, 25% would be transferred to standard care and 36% of patients would have head trauma.

For patients treated with KT who have head trauma, 7% will have NP, 36% other LRTIs and 57% no infection.

For patients treated with KT who have no head trauma, 16% would have NP, 3% other LRTIs and 81% no infection.

For patients treated with KT and transferred to standard care, with head trauma, 50% would have NP, 27% other LRTIs and 23% no infection.

For patients treated with KT and transferred to standard care, with no head trauma, 31% would have NP, 11% other LRTIs and 58% no infection.

For patients treated with standard care who have head trauma, 50% would have NP, 27% other LRTIs and 23% no infection.

For patients treated with standard care who have no head trauma, 31% would have NP, 11% other LRTIs and 58% no infection.

Measure of benefits used in the economic analysis
The measures of benefit used were the probability of developing pneumonia, the probability of developing other LRTIs,
and the probability of no respiratory infections.

**Direct costs**
The direct costs included in the study were those of the resources used by patients in each group. As these were difficult to obtain, the amount saved by the number of respiratory infections prevented in each group was used instead. It was unclear which sources were used for the different costs. Patients treated with KT spent 5 days in the ICU at an average total cost of $750. Patients assigned to a KT bed, but not treated there, had an average total cost of $375. The total cost of treating an episode of pneumonia was based on a study by Baker, but this does not appear to have been reported in the current paper. Other costs were taken from published literature, but the sources and costs were not stated clearly. Discounting was not relevant since the timeframe was less than one year.

**Statistical analysis of costs**
There was no statistical analysis of the costs.

**Indirect Costs**
No indirect costs were used in the study.

**Currency**
US dollars ($).

**Sensitivity analysis**
A sensitivity analysis was conducted to investigate areas of uncertainty, such as the probability of developing NP and other LRTIs and the cost estimates of treating the acquired infections. A one-way sensitivity analysis appears to have been carried out.

**Estimated benefits used in the economic analysis**
For those in the KT group, there was a 34.4% chance of developing a respiratory infection, pneumonia or other similar conditions. For those in the ICU bed group, there was a 54.6% chance of developing a respiratory infection.

For every 1,000 patients who suffer trauma and who receive KT, 344 will develop an NP respiratory infection, compared with 546 patients who will develop a similar infection if using a standard ICU bed.

The use of KT would therefore result in 202 fewer incidences of infections for every 1,000 patients with trauma.

When the probability of a patient developing pneumonia while on KT was increased from 7 to 25%, the probabilities for the KT head trauma branch were 25% for developing NP, 36% for other LRTIs and 39% for no infection.

**Cost results**
The excess treatment cost of pneumonia was $30,957 ($38,519 when appreciated to 1999). The excess cost of treating nosocomial LRTI was $5,683 ($7,492 when appreciated to 1999).

The total expected cost of therapy was $15,831 for a standard ICU bed and $9,136 for a KT bed.

When the probability of a patient developing pneumonia while on KT was increased from 7 to 25%, the total expected cost-saving of using KT was $4,823 per patient for the head trauma branch.

The cost estimate associated with acquired infection was varied. The excess costs associated with treating pneumonia were varied from $1,000 to $50,000. This had the effect of varying the cost-differential from $398 to $8,819 in savings.
The break-even point for the cost of treating pneumonia for these patients, above which KT was cost-effective (and below which it was not cost-effective), was $3,117.

When the excess cost of treating LRTI other than pneumonia was varied from $1,000 to $25,000, the cost-saving associated with KT varied from $6,603 to $6,942.

**Synthesis of costs and benefits**

The authors calculated the cost per respiratory infection avoided.

If all 1,000 patients were treated with KT there would be an increased cost of $656,250.

The incremental cost to avoid infection of the 1,000 patients would be $656,250 divided by 202 (the reduction in cases of infection). Therefore, there would be a reduction of $3,249 per case of respiratory infection avoided.

**Authors' conclusions**

Kinetic therapy (KT) is a cost-effective treatment for critically ill patients. On average, the cost-savings were $6,695 per patient each year when compared with an average intensive care unit (ICU) bed. These savings were achieved through a reduced incidence of nosocomial pneumonia (NP) and other lower respiratory tract infections (LRTIs) among patients using KT.

**CRD COMMENTARY - Selection of comparators**

The choice of the comparator used would appear to represent current practice in the authors' setting. You should decide if the comparator represents current practice in your own setting.

**Validity of estimate of measure of effectiveness**

The authors did not state that a systematic review of the literature had been undertaken. They appear to have used data from the available studies selectively. The estimate of effectiveness was derived credibly from the primary studies.

**Validity of estimate of measure of benefit**

The estimation of benefit was modelled. The instrument used to derive the measure of benefit (a decision tree) was appropriate.

**Validity of estimate of costs**

All the categories of cost relevant to the perspective adopted were included in the analysis. Some relevant costs were omitted from the analysis, although these were unlikely to have affected the authors' conclusions. In addition, not all the costs were stated clearly in the paper. The authors commented that any costs that were identical for each therapy were excluded. The costs and the quantities were reported separately for certain costs. A sensitivity analysis was conducted of the prices, but not the quantities. A consumer price index was used to inflate all prices to 1999.

**Other issues**

The authors made appropriate comparisons of their findings with those from other studies. The issue of generalisability to other settings was addressed. The authors do not appear to have presented their results selectively. The study investigated patients treated in the ICU for trauma and this was reflected in the authors' conclusions.

**Implications of the study**

KT should be considered for all patients who are at risk of NP in a critical care setting.
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Other publications of related interest


Indexing Status
Subject indexing assigned by NLM

MeSH
Beds; Biomechanical Phenomena; Cost Savings; Cost-Benefit Analysis; Critical Care /methods; Cross Infection /complications /prevention & control; Decision Trees; Drainage, Postural /economics /methods; Humans; Intensive Care Units /economics; Length of Stay; Respiratory Tract Infections /complications /prevention & control; Retrospective Studies; Wounds and Injuries /complications

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