Heat-and-moisture exchangers used with biweekly circuit tubing changes: effect on costs and pneumonia rates

Salemi C, Padilla S, Canola T, Reynolds 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
The use of a heat-and-moisture exchanger (HME), a piece of ventilator equipment that permitted less frequent circuit changes, was examined.

Type of intervention
Primary prevention.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised patients who required ventilation in a medical centre.

Setting
The setting was secondary care. The economic study was conducted in the Kaiser Permanente Medical Center, Fontana (CA), USA.

Dates to which data relate
The effectiveness and resource use data were gathered from 1989 to 1999. The price year was unclear but it appears to have been 1999.

Source of effectiveness data
The effectiveness evidence was derived from a single study.

Link between effectiveness and cost data
It was unclear whether the costing was carried out on the same sample of patients as that used in the effectiveness study. It was also unclear whether the costing was conducted prospectively or retrospectively.

Study sample
The use of power calculations was not reported, nor were the methods used to select the sample and the size of the sample. It appears that all patients receiving ventilation at the study centre have been included in the analysis. The demographics of the patients were not reported. Two groups of patients were considered, those who were ventilated with the traditional device and those who were ventilated with the new equipment. No information on the number of patients included in the two groups was provided.
Study design
The design of the study was unclear although it could have been a comparative study. It was not stated whether the two groups were studied prospectively or retrospectively. The study was conducted in a single centre, the Kaiser Permanente Medical Centre in Fontana, California. The length of and loss to follow-up were not reported.

Analysis of effectiveness
The basis of the analysis of the clinical study was not reported. The outcome measure used in the analysis was the rate of VAP. This was estimated from 1989 to 1999. The HME was introduced in 1991. The criteria for determining the presence of pneumonia were based on guidelines of the Centers for Disease Control and Prevention. The baseline comparability of the groups of patients was not discussed.

Effectiveness results
The rate of VAP was 8% in 1991. This was considered the baseline value, just before the introduction of the HME. The rate remained stable through to 1999. The actual figures across the years were not reported in the text, but they were depicted graphically.

Clinical conclusions
The effectiveness analysis showed that the introduction of the HME did not result in a higher rate of VAP in patients requiring ventilation.

Measure of benefits used in the economic analysis
No summary benefit measure was used because the two interventions were considered equally effective. In effect, a cost-minimisation analysis was conducted.

Direct costs
Discounting was not relevant since the costs per patient were incurred during a short time. However, discounting of the amortisation costs could have been relevant, but was not reported. The health services included in the economic evaluation were circuit changes, water and column changes, a water trap for condensation, cleaning, sterilisation, the packaging of tubes and connectors, thermometers, repairs and replacement of equipment pieces, labour and the HME. The cost/resource boundary of the study was not reported. The source of the costs was not explicitly reported, but it was likely to have been the hospital. Resource use was estimated using data derived from the effectiveness study, assuming an average of 16 ventilators were used per day. The price year was presumably 1999.

Statistical analysis of costs
No statistical analyses of the costs were conducted.

Indirect Costs
The indirect costs were not considered in the economic evaluation.

Currency
US dollars ($).

Sensitivity analysis
Sensitivity analyses were not performed.
Estimated benefits used in the economic analysis
See the 'Effectiveness Results' section.

Cost results
The estimated total costs were $180,011 in 1990 (when old ventilators were used) and $23,000 in 1996 (when the HME was used). There was a cost-saving of $157,011 in favour of the HME intervention.

It was estimated that the annual cost-savings for a single ventilator would be approximately $9,813 with the introduction of the HME.

Synthesis of costs and benefits
The costs and benefits were not combined because a cost-minimisation analysis was conducted.

Authors' conclusions
The introduction of the heat-and-moisture exchanger (HME) resulted in substantial cost-savings without any impact on the rate of ventilator-assisted pneumonia (VAP).

CRD COMMENTARY - Selection of comparators
The choice of the comparators was appropriate since the traditional ventilation system used before the introduction of the HME was selected as the basic comparator. You should decide whether it represents a valid comparator in your own setting.

Validity of estimate of measure of effectiveness
The analysis of effectiveness used a comparative study, but very few details of the methods and design of the study were provided. The size of the overall sample of patients considered in the analysis was not reported and it was unclear whether the study was conducted prospectively or retrospectively. The comparability of the two study periods was not discussed. This represents a strong drawback since the outcomes were assessed during two different timeframes. The characteristics of the patients were not reported. Likewise, information on the length of and loss to follow-up was not given. These issues limit the internal validity of the analysis. Overall, the effectiveness analysis was not conducted satisfactorily.

Validity of estimate of measure of benefit
No summary benefit measure was used in the analysis because a cost-minimisation analysis was conducted.

Validity of estimate of costs
Only a few details of the cost analysis, namely the cost categories and source of resource use data, were reported. The authors did not provide other pieces of information that could have been used, such as the unit costs, perspective of the study and source of the costs. No discussion on the relevance of discounting was presented. Overall, it would appear difficult to replicate the study in other settings. All the estimates were treated deterministically and no statistical tests were conducted when comparing the costs. The cost estimates were specific to the study setting and no sensitivity analyses were conducted.

Other issues
The authors compared their findings with those from published studies that showed similar results in terms of no differences in VAP rates. However, the issue of the generalisability of the study results to other settings was not addressed and sensitivity analyses were not conducted. Therefore, the external validity of the analysis was low. The study referred to patients requiring ventilation and this was reflected in the authors' conclusions.
Implications of the study
The study showed the financial advantages of biweekly equipment for ventilation. However, caution is required when interpreting the results of the study due to the limitations of the effectiveness and cost analyses.

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Other publications of related interest


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