Intensive care unit physician staffing is associated with decreased length of stay, hospital cost, and complications after esophageal resection

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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
The effect on patients who have had oesophageal resection of having daily rounds by an intensive care unit (ICU) physician was compared with a situation in which there were not daily rounds.

Type of intervention
Treatment.

Economic study type
Cost-effectiveness analysis.

Study population
The study population consisted of adult patients who had undergone oesophageal resection.

Setting
The setting was secondary care in Maryland, USA (non-federal hospitals).

Dates to which data relate
Dates for effectiveness evidence were 1994-1998 and the dates of resources used were 1994-1998. The price year was 1998.

Source of effectiveness data
Effectiveness data were derived from a single study.

Link between effectiveness and cost data
Retrospective costing was carried out on the same sample of patients as that used in the effectiveness study.

Study sample
No power calculations were reported. It was the aim of the study to include all 366 (the total population) of adult patients in non-federal hospitals in Maryland who had undergone oesophageal resection. All 35 hospitals were asked to participate in the study but only 31 did so, and so 351 patients were included in the study. There were 169 (mean age 62 (SD 12), 87% white, 79% male) in the group that had daily rounds by an ICU physician, and 182 (mean age 59 (SD 12), 74% white, 79% male) in the group that did not. The non-responding hospitals were studied and were similar to responding hospitals in terms of patient and hospital characteristics and outcomes.
Study design
This was a cohort study in which 31 centres gave information on patients. There was only information up to the point of hospital discharge and there was no follow-up after discharge.

Analysis of effectiveness
The study was based on the medical records of all patients in the 31 participating hospitals, and, as such, the analysis was based on treatment completers only. The primary health outcomes used were in-hospital mortality rate, length of hospital stay and postoperative complications. The authors tested for comparability between the two groups in terms of demographic characteristics and comorbid disease states. They were found to be similar in all respects except that more patients in the non-daily rounds group had emergent admission (p=0.001) and had pre-existing peripheral vascular disease (p<0.001). The effect of potential confounding variables was adjusted for in the analysis, viz: comorbidity, severity of illness, hospital and surgeon volumes and demographic factors.

Effectiveness results
The effectiveness results were as follows:

The overall in-hospital mortality rate was 4% in hospitals that had daily rounds and 14.2% in those that did not, (p=0.003).

Neither emergency admission nor pre-existing vascular disease was significantly associated with in-hospital death.

Regression analyses were used to determine if the different mortality rates apparently associated with the presence of daily rounds could be explained by other factors, such as the volume of patients (for surgeon and hospital), comorbid disease, severity of illness, and demographic factors.

When hospital and surgical volume was taken account of, the size of the effect of daily round was reduced to an odds ratio (OR) of 1.5, which was not statistically significant.

The median length of stay for patients with daily rounds was 9 days and 15 days for those without daily rounds, (p<0.001).

In the regression analysis the effect of not having daily rounds was to increase the median length of stay by 7 days, (p=0.012).

In-hospital mortality rate was significantly associated with the following postoperative complications: pulmonary insufficiency (OR: 6.8; 95% CI: 2.7 - 17.5), renal failure (OR: 41.5; 95% CI: 11.9 - 144), pneumonia (OR: 2.7; 95% CI: 1.1 - 6.8), postoperative infection (OR: 3.8; 95% CI: 1.2 - 12.6), reintubation (OR: 5.7; 95% CI: 2.6 - 12.4), and septicemia (OR: 8.2; 95% CI: 2.5 - 26.9). All of the post-operative complications (apart from myocardial infarction and cardiac arrest) were associated with significant increases in the length of hospital stay.

Apart from myocardial infarction and cardiac arrest all other complications occurred more frequently without daily rounds. However some complications were affected far more than others. For example the odds ratio for suffering from pulmonary insufficiency was 4.0 (p=0.008) and the odds ratio for acute renal failure was 6.3 (p=0.18). The only odds ratio that was statistically significant (p=0.001) was that for reintubation, OR 2.8 (95% CI: 1.5 - 5.2).

The study did not report the effects of daily rounds on post-operative complications when taking account of other factors.

Clinical conclusions
In-hospital mortality is significantly associated with postoperative complications, which occur more frequently among patients not receiving daily rounds. Daily rounds by an ICU physician are significantly associated with a reduction in the length of hospital stay in patients who have had oesophageal resection.
Modelling
Regression modelling was used to estimate the effect of daily rounds on in-hospital mortality, postoperative complications, length of stay and healthcare costs.

Measure of benefits used in the economic analysis
No summary measure of benefit was used in the economic analysis. The outcomes (see effectiveness results above) were left disaggregated. The economic analysis was therefore based on a cost-consequences approach.

Direct costs
Costs were calculated by converting hospital charges (excluding professional fees) to total hospital costs, using the hospital-specific ratio of costs to charges obtained from the Maryland Health Services Cost Review Commission (HSCRC) for 1994-1998. All costs were converted to 1998 prices using the consumer price index for health care. Discounting was not carried out but was not relevant as costs were incurred over a short time (less than 1 year). Quantities and costs were not analysed separately. Incremental costs were provided.

Statistical analysis of costs
Within the regression analyses tests of significance were utilised on explanatory variables. The median and interquartile range (IQR) results were reported for costs after adjusting for patient and hospital characteristics.

Indirect Costs
No indirect costs were calculated.

Currency
US dollars ($).

Sensitivity analysis
No sensitivity analysis was carried out.

Estimated benefits used in the economic analysis
Due to the cost-consequences approach the reader is referred to the effectiveness results reported above.

Cost results
The median total costs for patients' receiving daily rounds was $14,424 (IQR: $12,936 - $18,246) and $23,335 (IQR: $16,703 - $39,090) for patients not receiving daily rounds, (p<0.001).

When account was taken of other variables, the median total hospital costs were estimated by regression analysis to be $8,839 (95% CI: $1,674 - $19,192; p=0.013) higher in the group of patients not receiving daily rounds as a result of not getting daily visits. This represents a 61% (95% CI: 12% - 133%) difference. As such an incremental cost analysis was performed.

Synthesis of costs and benefits
Costs and benefits were not combined as a cost-consequences approach was taken. However the results indicate general dominance for the daily rounds alternative as it was associated with lower costs and improved post-operative complications (but showed no association with the in-hospital mortality rate).
Authors' conclusions
Daily rounds by an ICU physician lead to fewer post-operative complications among patients who have had oesophageal resection, which is reflected in the shorter length of stay for these patients. Daily rounds also decrease the hospital costs for these patients.

CRD COMMENTARY - Selection of comparators
The comparator was justified as it represented common practise, however the authors did not justify the fact that all regimes of 'no daily rounds' were put together as comprising one type of care, rather than introducing a variable representing the frequency of physician visits.

Validity of estimate of measure of effectiveness
The analysis was based on hospital records, comparing the results of different hospitals, and there will therefore be potential biases and confounding variables in terms of patient outcomes between hospitals and in terms of whether it is possible to account for the differences by the observable variables which the authors consider. The patients in the two groups were shown to be comparable in terms of demographic characteristics and co-morbid disease states except for emergent disease and pre-existing peripheral vascular disease, the frequency of which was higher in the group receiving daily rounds, (p=0.001 and p<0.001).

The analysis of effectiveness was handled credibly on the whole, the authors concluding that daily rounds did not affect in-hospital mortality when account was taken of other variables. However, they did show that there is an increased risk of in-hospital mortality, but that it is not statistically significant. With a larger sample size, this risk might be shown to be statistically significant.

Also, the information on staffing practices in the hospitals was derived from questionnaires completed in 1996, and it is possible that practice changed after this date, although the authors stated that any change after this date would only be in the direction of increasing the number of rounds so that hospitals classified as not having daily rounds would have started daily rounds. This possibility would mean that the effect of daily rounds would have been underestimated.

Validity of estimate of measure of benefit
The estimation of benefits was obtained directly from the effectiveness analysis, which examined the consequences for in-hospital mortality and post-operative complications. The cost-consequences approach was appropriate both to the patient domain studied and to the intervention.

Validity of estimate of costs
Not all relevant categories of cost were included and the authors did not explain why they excluded professional fees. Presumably the reason why some hospitals do not have daily rounds is because of the increased physician cost. The authors did not include indirect costs. Inclusion of indirect costs would have increased the cost for those hospitals that did not have daily rounds, and thus the cost difference between the two groups would have been even larger. This would have meant that the cost advantage would have been even greater for hospitals that did have daily rounds.

Costs and quantities were not reported separately. A good feature of the cost analysis was that hospital charges were converted to hospital costs using the Health Services Cost Review Commission, which increases the generalisability of the results to other settings.

Other issues
The authors did make appropriate comparisons of their results with the findings of other studies but did not discuss the issue of generalisability to other settings. The authors acknowledged some of the limitations of regression analysis in determining causality by pointing out that they have found an association rather than established a causal relationship. However they did not discuss the possibility that their results could be explained in a different way as they show, for example, that hospital volume and surgeon volume are also important variables in determining health outcomes for
patients after oesophageal resection. They did not discuss the possibility that a hospital with a good reputation would attract a greater volume of patients and also have better health outcomes. It might be that a good hospital with a good reputation is also a hospital that has daily rounds, in other words that the overall quality is better in several ways, one of which is daily rounds. As such there may be confounding variables not addressed in the analysis.

**Implications of the study**
The authors state that their study shows better health outcomes for patients when they have daily rounds from an ICU physician after oesophageal resection. A supplementary finding was that large hospital volume is also associated with better outcomes. The authors state the limitations of observational studies of this nature and point out that a randomised controlled trial would be the best way to determine the effect of daily rounds. Ideally one would like to see a study in which outcomes could be compared between patients whose only difference was the fact that they either did or did not have daily rounds from an ICU physician.

**Source of funding**
None stated.

**Bibliographic details**

**PubMedID**
11373463

**Other publications of related interest**
Comment In: Critical Care Medicine 2001;29(4):904-5.

**Indexing Status**
Subject indexing assigned by NLM

**MeSH**
Comorbidity; Esophagus /surgery; Female; Hospital Mortality; Humans; Intensive Care Units /economics; Length of Stay; Male; Maryland; Middle Aged; Outcome Assessment (Health Care); Physician's Role; Postoperative Care /economics; Postoperative Complications; Prospective Studies

**AccessionNumber**
22001000918

**Date bibliographic record published**
31/10/2002

**Date abstract record published**
31/10/2002