Effect of a collaborative weaning plan on patient outcome in the critical care setting
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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 health intervention examined in the study was the implementation of an innovative, multidisciplinary, weaning plan to improve collaborative decision making for the management of critically ill patients receiving mechanical ventilation. The weaning plan was developed by collaboration among staff members (nurses, physicians, respiratory therapists, pharmacists, dieticians, and other support staff) in a medical intensive care unit (MICU), and was documented through a weaning board and a weaning flowsheet. The former was used to communicate to the team (as well as to the patients and their families) important data related to patient’s readiness to wean and the plan for weaning for the day. The latter was used to record the weaning process and patient’s response. Any member of the MICU team could fill out the weaning board and flowsheet.

Type of intervention
Treatment and organisational issues.

Economic study type
Cost-effectiveness analysis.

Study population
The study population included patients admitted to the MICU, receiving mechanical ventilation either via a tracheostomy or endotracheal tube for 3 or more days. Patients were excluded if weaning from the ventilator was not the primary goal (e.g. patients with neuromuscular disease requiring partial or continuous support).

Setting
The study was set in an eight-bed MICU in a teaching hospital. The economic study was carried out in Los Angeles, California, USA.

Dates to which data relate
Both effectiveness and resource use data were collected from July 1995 to June 1997. The price year was not reported.

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

Link between effectiveness and cost data
The costing was undertaken prospectively on the same patient sample as that used in the effectiveness analysis for the intervention group.

Study sample
Power calculations were performed in the planning phase: a power analysis using an alpha of 0.05, a moderate effect size, and a beta of 0.80 determined that a sample size of 140 patients (70 per group) would be required to detect a significant difference between groups. A total of 207 patients was included in the study and 6 outliers (3 per group, 3% of the total sample) were immediately excluded (their length of ventilator time and intensive care unit (ICU) stay were stated to have been skewed in comparison with the remaining subjects). A final sample of 201 patients was considered: 77 individuals (mean age 58.2 +/-18.4 years, 43% female) in the comparison group and 124 subjects (mean age 59.2 +/-16.4 years, 48% female) in the intervention group. Clinical baseline characteristics were also given. Patients were recruited from July 1995 to June 1996 in the control group and from July 1996 to June 1997 in the intervention group.

**Study design**
The study was a non-randomised controlled trial (pre- and post-quasi-experimental design), with an historical control group. It was carried out in a single centre. The duration of follow-up was not reported. No blinding method for outcome assessment was reported. However, the authors stated that the majority of health care providers, patients and families were unaware on the specific outcome variables being assessed. There were no losses to follow-up. The duration of follow-up was not reported.

**Analysis of effectiveness**
The basis for the analysis of the effectiveness (intention to treat or treatment completers only) was not reported. The primary health outcomes assessed were: length of time patients received mechanical ventilation, length of stay in the MICU, number of patients successfully weaned off, complications (such as mortality rate, incidence of reventilation, and need of readmission to any ICU in the hospital), and some organisational variables, such as staffing patterns, years of experience of nursing and respiratory therapy staff, and management changes. Groups were shown to be comparable, (p>0.05) with respect to age, gender, presence of chronic lung disease, or Acute Physiology and Chronic Health Evaluation (APACHE) II scores. Groups were also similar in terms of admitting diagnoses.

**Effectiveness results**
The effectiveness results were as follows:

The length of time patients received mechanical ventilation and length of stay in the MICU were 10.3 +/-9 (median = 9) days and 12 +/-9.8 (median = 9) in the intervention group and 13 +/-10.7 (median = 11.8) days and 15.6 +/-13.3 (median = 12.8) days in the control group, respectively. The difference in length of stay in the MICU was statistically significant, (p=0.03; 95% CI: 0.32 - 6.79).

The number of patients successfully weaned off was 62 (50%) in the intervention group and 31 (40%) in the control group, (p=0.18).

Intervention and control groups were similar in terms of mortality rate (42% versus 48%, p=0.40), incidence of reventilation (10% versus 6%, p=0.90), and need for readmission to any ICU in the hospital (10% versus 6%, p=0.90), experience of nursing staff (5.4 +/-2.8 years versus 4.3 +/-2.7 years, p=0.82) and respiratory therapy staff (8.8 +/-7.4 years versus 9.5 +/-6.5 years, p=0.63).

The MICU leadership group remained the same during the study period and there were no management changes.

**Clinical conclusions**
The analysis showed the effectiveness of the implementation of a multidisciplinary, collaborative weaning plan, which reduced the length of days spent in the MICU, with non-statistically significant differences in other measures.

**Measure of benefits used in the economic analysis**
Health outcomes were left disaggregated and no summary benefit measure was used, therefore a cost-consequence analysis was carried out.
Direct costs
Discounting was not carried out given that costs occurred in a very short period of time. Unit costs and quantities were not reported separately and the resource/cost boundary adopted was not indicated. The categories of costs included in the analysis were not reported. The estimation of costs was based on standardised Medicare reimbursement rates and was obtained from the hospital billing department. The quantities of resources were collected during the trial for the intervention group, but it was not stated when the resources for the comparison group were gathered. The price year was not reported.

Statistical analysis of costs
A statistical analysis of costs was reported.

Indirect Costs
No indirect costs were included.

Currency
US dollars ($).

Sensitivity analysis
No sensitivity analysis was carried out.

Estimated benefits used in the economic analysis
See effectiveness results above.

Cost results
The average cost per MICU was equal to $42,213.24 (+/-$53,457) in the intervention group and $52,789.70 (+/-$52,113.82) in the comparison group, but the difference was not statistically significant, (p=0.16).

Synthesis of costs and benefits
Not applicable.

Authors’ conclusions
The study has indicated that co-ordination and multidisciplinary decision making for a weaning plan, using weaning board and flowsheet, was effective in reducing the length of stay in the expensive ICU setting, although the difference in costs did not reach the statistical significance level.

CRD COMMENTARY - Selection of comparators
The selection of the comparator was clearly represented by the routine practice for the management of patients in MICUs, in that the objective of the study was to assess the actual impact of the introduction of the collaborative weaning approach in the structure. A major difficulty with complex technologies is that of their precise definition. In this case, details were given of the two technologies, but as will be stated later, data were lacking regarding the precise quantities of resources involved in each technology. You should consider whether the practice of no-multidisciplinary-approach represents the standard care in your own setting.

Validity of estimate of measure of effectiveness
The effectiveness analysis was based on a quasi-experimental design, with a historical control group. A possible limit to the validity of the study could have been the lack of randomisation, although extensive statistical analyses were conducted to show the comparability of the two groups. The authors also highlighted that the choice of a historical comparison group could have been problematic, because it was "possible that the outcomes that occurred between the two study periods resulted from events other than the intervention". The possibility of considering another ICU in the same hospital was also assessed, but the populations were too different.

**Validity of estimate of measure of benefit**
There was no summary measure of benefit. Please refer to the commentary on measure of effectiveness above.

**Validity of estimate of costs**
The cost estimates were quite specific to the Medicare setting. Very few details about resource use or costs were reported, which limits the assessment of confounding and, more particularly, generalisability. Furthermore, the perspective of the study was not stated and it was not clear whether all relevant categories of costs were included in the economic analysis. Also, the price year was not reported.

**Other issues**
The authors made several comparisons of their analysis with other published studies and their results appeared to support the existing literature. However, the issue of the generalisability to other settings was not specifically addressed and sensitivity analyses were not conducted, therefore limiting the external validity of the study.

**Implications of the study**
The authors stated that the analysis suggested that efforts should be directed, not at applying a single intervention, but at "creating the best environment for weaning through the use of structure and processes, which support a collaborative weaning process". The approach adopted in the study may represent a feasible alternative, because it is based on existing personnel and does not require the set-up of an expensive specialised team. These conclusions should be judged within the above commentaries, with particular attention to the difficulty of generalising to other settings.

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