Effect of the critical care outreach team on patient survival to discharge from hospital and readmission to critical care: non-randomised population based study

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Abstract

Objectives To determine the effect of the critical care outreach team on patient survival to discharge from hospital after discharge from critical care and readmission to critical care.

Design Non-randomised population based study.

Setting Tertiary referral teaching hospital with 1200 beds.

Participants Patients discharged from the critical care unit after their first or only admission for two study periods, 26 February 2000 to 25 February 2001 and 26 February 2001 to 25 February 2002.

Main outcome measures Survival to discharge from hospital after discharge from critical care and readmission to critical care.

Results The introduction of a critical care outreach team improved survival to discharge from hospital by 6.8% (risk ratio 1.08). Readmission to critical care decreased by 6.4% (0.48).

Conclusions The activity of the critical care outreach team seems to improve patient survival to discharge from hospital and may reduce the number of readmissions to critical care.

Introduction

The report Comprehensive Critical Care identified a strategy for change that has begun to transform the delivery of critical care services in England and Wales. Many of the recommendations in the report are subsumed under the broad remit of critical care outreach teams. Perhaps the most important of these recommendations was the development of patient at risk teams and follow up services to complement critical care while improving the speed and quality of patient recovery to discharge from hospital. The need for this service was based on several reports, which indicated suboptimal management of both patients discharged from intensive care and at risk of deterioration on hospital wards. The same year a report published by the Scottish Executive concluded that outreach teams and follow up would not significantly optimise patient care or affect the workload of intensive care units.

More recently, critical care outreach teams have been challenged to produce robust evidence of effectiveness to justify the substantial investment in them made by the government. Evidence is emerging from Australia that the activity of medical emergency teams, introduced in the early 1990s, may substantially reduce the incidence of cardiac arrest and unanticipated admission to intensive care. Such teams, however, differ from patient at risk teams that have developed in England and Wales. Medical emergency teams are usually a medical team, including a senior nurse, trained and experienced in acute hospital medicine. Patient at risk teams tend to be nurse led. Therefore the results from Australia cannot be extrapolated to England and Wales, despite both teams responding to early physiological warnings (box). We aimed to determine the effectiveness of follow up services during the period between discharge from critical care to discharge from hospital and on readmission to critical care.

Participants and methods

The critical care outreach team of the Royal Free Hampstead NHS Trust was established in February 2001. The team of five senior critical care nurses is led by a consultant nurse. The service is available for 12 hours daily. The trust has 1200 beds, including 20 critical care beds. Data collection during the study was...
Table 1 Most common interventions performed by critical care outreach team

<table>
<thead>
<tr>
<th>Intervention</th>
<th>No (% of interventions n=2792)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guiding tracheotomy management</td>
<td>282 (10.7)</td>
</tr>
<tr>
<td>Performing tracheal suction and chest physiotherapy</td>
<td>243 (8.7)</td>
</tr>
<tr>
<td>Guiding management of continuous positive airways pressure</td>
<td>232 (8.3)</td>
</tr>
<tr>
<td>Optimising patient positioning (sitting up, side lying)</td>
<td>223 (7.9)</td>
</tr>
<tr>
<td>Requesting prescription or administration of nebuliser therapy</td>
<td>199 (7.1)</td>
</tr>
<tr>
<td>Requesting repeat blood testing*</td>
<td>192 (6.9)</td>
</tr>
<tr>
<td>Increasing the frequency of CVS/respiratory observations</td>
<td>155 (5.5)</td>
</tr>
<tr>
<td>Starting hourly fluid balance monitoring</td>
<td>101 (3.6)</td>
</tr>
<tr>
<td>Requesting samples be sent for microculture and sensitivity</td>
<td>89 (3.2)</td>
</tr>
</tbody>
</table>

*Full blood count, urea, and electrolytes.

Limited to a site with 13 beds owing to the ongoing expansion of the critical care clinical audit team.

Operational policy of team

Patients discharged from critical care are assessed by the critical care outreach team at least once daily. Any interventions required are performed by the outreach team or by nursing and medical staff on the ward, depending on the skill required. The outreach team alert staff to patients showing deterioration. The emphasis of the follow up service is rehabilitative. Table 1 outlines the most common interventions performed by the outreach team. Table 2 shows the types of referrals to specialists recommended by the outreach team.

Table 2 Most common referrals to specialists by critical care outreach team

<table>
<thead>
<tr>
<th>Intervention</th>
<th>No (%) referred (n=442)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parent medical team</td>
<td>195 (44)</td>
</tr>
<tr>
<td>Speech and language therapists</td>
<td>53 (12)</td>
</tr>
<tr>
<td>Physiotherapist</td>
<td>49 (11)</td>
</tr>
<tr>
<td>Critical care registrar</td>
<td>48 (11)</td>
</tr>
<tr>
<td>Pain management team</td>
<td>29 (7)</td>
</tr>
<tr>
<td>Dietitian</td>
<td>21 (5)</td>
</tr>
<tr>
<td>Ear, nose, and throat team</td>
<td>14 (3)</td>
</tr>
<tr>
<td>Various others</td>
<td>30 (7)</td>
</tr>
</tbody>
</table>

Critical care outreach teams seem to improve survival to discharge from hospital after discharge from critical care and may reduce the number of readmissions to a significant extent. The activity of the outreach team differs from that of medical emergency teams and patient at risk teams. Critical care outreach teams have developed on an ad hoc basis in England and Wales.
They differ widely in composition, ranging from lone consultant nurses to multiprofessional teams, and in their working patterns and activity. Some outreach teams follow up patients as described in our study, whereas others attend once patients show early warning criteria (see box). The results of our study are therefore not transferable.

Patients are at increased risk of deterioration during the recovery period after discharge from critical care, attributable to early discharge and residual organ dysfunction. Both often lead to readmission, which in turn is associated with higher inhospital mortality. Although we present only a preliminary examination of what can be achieved through fundamental interventions and referrals made by experienced critical care nurses during the recovery period, our findings do provide some evidence that this type of innovation is worth while for patient survival and readmission.

A recent study could detect no change in patterns of readmission after the introduction of a critical care outreach team. It is difficult to extrapolate from the report if the operational policy was similar to that described in our study, and although the setting seems similar, a far larger sample was examined. The readmission rate for both study periods was 4.0%, unlike our study, which found a reduction of 12.4% compared with 6.0% after the introduction of the outreach team. A readmission rate of 4.0% is below the national average of 6.3% reported by the Intensive Care National Audit Research Centre, indicating that there was little room for the effect of the outreach team to be shown in terms of readmission.

Survival to discharge from hospital has been determined in medical patients after discharge from critical care. These patients were chosen because of the high mortality associated with critical illness. Survival was thought to have been affected by a change in resuscitation status, where seven of the 12 patients who survived critical care had their resuscitation status altered to do not resuscitate. It is unlikely that this applied to our study because survival to discharge improved and it is unlikely that this would have occurred if patients had had their resuscitation status altered. A more unlikely reason is that decisions about not resuscitating were made but that patients then survived to discharge from hospital. Alternatively, the proportion of medical patients differed between the two periods under study, but this was not the case.

**Strengths and limitations**

Our study design could have confounded the results; before and after studies are retrospective, therefore variables cannot be controlled. In our study a concomitant innovation in the hospital could have produced the same results. Patients were, however, discharged from critical care to different areas of the hospital, and at the time of the study there was no other innovation that could have had an effect on patients. The median predicted probability of mortality was 16.1% compared with 20.4% in the historical cohort. Although this was not statistically significant, part or all of the effect seen might be explained by this difference. Several authors have, however, questioned the ability of the tool to predict mortality and it is currently the subject of further investigation by the Intensive Care National Audit Research Centre. The tool therefore might explain some of the variation in outcome but not all of it.

Before and after studies may also show a lack of equivalence between comparators, and interventions may vary. Both our groups had similar risk factors. These were chosen for their association with mortality and readmission and seemed to be appropriate for the purposes of our study. The interventions undertaken by team members did vary; possibly owing to length of time available for the intervention or the manner in which the intervention was undertaken by the individual and on a particular day. It is unlikely, however, that one individual or one intervention can be associated with the findings. Rather, the combined effect of the interventions seems to have had a beneficial effect on outcomes.

The use of routine audit data, rather than specific data collected for research purposes, may also have produced erroneous results. The database was examined on a random basis for reliability and seemed sound.

Our small sample size increased the risk of a type 2 error, which is much smaller than those used to test the equivalence between comparators, and interventions may vary. Both our groups had similar risk factors. These were chosen for their association with mortality and readmission and seemed to be appropriate for the purposes of our study. The interventions undertaken by team members did vary; possibly owing to length of time available for the intervention or the manner in which the intervention was undertaken by the individual and on a particular day. It is unlikely, however, that one individual or one intervention can be associated with the findings. Rather, the combined effect of the interventions seems to have had a beneficial effect on outcomes.

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effectiveness of medical emergency teams or the effect on readmission rates.\textsuperscript{6} If the innovation described here had not been introduced so hastily, owing to political imperative, we could have conducted a prospective randomised controlled trial. Evidence for innovation in service delivery will always be prone to limitations where evaluation is not undertaken before wholesale application. Policy makers should consider testing health service innovation using cluster randomised controlled trials with the hospital as the sampling unit. An example of this is the medical early response intervention and therapy study currently being undertaken in Australia to assess medical emergency teams.\textsuperscript{19}

Contributors: Heather Byers, Mary Fogarty, Joanna Hoyland, and Richard Ward (members of the critical care outreach team) participated in data collection and analysis. Dominic Cox (clinical scientist) and Demissie Tulu (auditor, Critical Care Audit Team) checked the reliability of the dataset. Steve Shaw (lead consultant for critical care) and Julian Howard (consultant critical care) critically reviewed drafts of the manuscript. SW compiled and analysed the database. CB and MK contributed to the concept, design, and implementation of the study, drafted the manuscript, and read and approved the final version. All authors will act as guarantors for the paper.

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Competing interests: None declared.

Ethical approval: Permission from the local ethics committee was not sought as the study involved secondary analysis of audit data collected on a routine basis.