Evaluation of outreach services in critical care

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1. Executive summary

Introduction

In May 2000, with the publication of Comprehensive Critical Care, critical care outreach services (CCOS) were formally promoted as Department of Health policy as an important component of their "vision for future critical care services". This policy was promoted despite lack of evidence for benefit and without any ongoing evaluation. Three essential objectives for CCOS were identified: to avert admissions (either preventing admission or ensuring timely admission); to enable discharges (that is, to support continuing recovery after critical care); and to share critical care skills with non-critical care staff. No explicit model for CCOS was promoted; Critical Care Networks and NHS Trust-wide Critical Care Delivery Groups were encouraged to develop their own locally customised service.

In the 1990s, it became apparent that many patients sustaining significant organ failure warranting critical care often exhibited abnormal physiological observations, sometimes for hours, before their final "collapse". Physiological track and trigger warning systems (TTs) were developed for use outside critical care areas with the objective of ensuring timely recognition of all patients with potential or established critical illness and timely attendance from appropriately skilled staff. TTs use periodic observation of selected basic vital signs (the "tracking") with pre-determined criteria (the "trigger") for requesting the attendance of more experienced staff, since 2000, usually in the form of the CCOS. A wide variety of TTs exist to detect patients whose condition is deteriorating but there is no clear evidence to indicate either which are valid and reliable or which is best.

In April 2003, the NHS Research and Development, Service Delivery and Organisation Programme called for an evaluation of CCOS. This study adopted a multi-disciplinary, multi-methods approach to evaluation and comprised linked sub-studies under two general themes: TTs and CCOS.

Methods

The evaluation of TTs comprised five sub-studies: a systematic review of studies covering the range of TTs, to explore the extent of their development and testing relative to methodological quality standards; a descriptive national survey, covering the introduction and use of TTs across acute NHS Trusts in England; an analysis of available TT data of suitable quality from NHS hospitals in England, to review all aspects of their validity and utility; a single-centre inter- and intra-rater reliability study of the more common TTs; and a qualitative evaluation to elicit a wide range of stakeholders' views on TTs.

The evaluation of CCOS comprised five sub-studies: a systematic review of evaluative studies, to explore the evidence for their impact; a descriptive national survey covering the introduction, implementation and current models across acute NHS hospitals in England; an interrupted time series at the critical care unit level, to explore their impact; a matched cohort analysis at the critical care patient level to evaluate their impact; and a qualitative evaluation to characterise

the impact of the introduction, development and current models of CCOS within acute NHS Trusts in England.

Results

TTs

There was little rigorous evidence for the validity, reliability and utility of TTs. The reported proportion of hospitals using some form of TT was almost 100%. The majority of hospitals reported using the Early Warning Score or some modification of it. Most hospitals reported that more than one member of staff was notified in the response algorithm, presumably graded by risk. Response within thirty minutes was reported as the agreed response time; a balance between the ideal (immediate) and the pragmatic (achievable).

Using a composite outcome measure for established critical illness, the sensitivities and positive predictive values were low and the specificities were generally acceptable. Low sensitivities may have been due, in part, either to rapidly deteriorating patients or to patients where no physiological warning of impending catastrophe, by virtue of the disease process, was likely or due to infrequent and non-standardised measurement of the physiological parameters. Low positive predictive values may have been due to legitimate triggering for potential rather than established critical illness. The summary ROC curve indicated that differences between TTs may have largely reflected differing trigger thresholds; evidence suggested that trigger thresholds were placed artificially high to manage workload. In terms of reproducibility, there was only fair to moderate agreement for measurement of the physiological parameters used to generate scores and for the scores; there was better agreement on the trigger. Reproducibility was partially a function of simplicity; intra-rater reliability was better than inter-rater reliability.

Many interviewees suggested that TTs were helping inexperienced staff identify sick and deteriorating patients, giving them “objective evidence”. TTs were seen to increase staff knowledge and understanding but this had to be finely balanced against over-reliance. Local issues were identified that might affect the accuracy of TTs. These ranged from lack of, or poor, use in some hospital areas, variation in use among staff and issues of completion and interpretation. Training, particularly informal training, was seen to be extremely important. Local issues were raised about response algorithms for TTs, predominantly around communication, delay, resistance, authority and documentation.

CCOS

There was insufficient robust, rigorous research on the impact of CCOS on patient or service outcomes. CCOS have evolved quickly and the overwhelming picture was one of diversity of service provision.

Presence of a formal CCOS was associated with a significant decrease in: CPR rates during the 24 hours prior to admission; out-of-hours admissions to the critical care unit; and acute severity of illness of admissions; for admissions from the ward. No sustained effect was seen on mortality or readmission rates for patients discharged alive from the critical care unit.

Patients with CCOS visit(s) pre-critical care unit admission, when matched by individual patient characteristics or by propensity score, were most associated with decreased CPR rates during the 24 hours prior to admission and increased critical care unit length of stay.

Patients with CCOS visit(s) post-discharge from the critical care unit, when matched by patient characteristics or propensity score, were most associated with decreased hospital mortality and decreased post-critical care unit, hospital length of stay.

The difference in mean total cost per patient between patients receiving CCOS visit(s)) post-discharge and matched controls ranged from -£289 to -£34. Though not statistically significant, the differences indicated a high probability that CCOS visits following discharge from critical care were cost effective, regardless of willingness to pay.

CCOS studied had different methods of operation and priorities. It was difficult to identify common themes except for an education role. The reassurance given to ward staff was the most important, quoted impact. This was linked to a feeling of empowerment arising out of educational activity. The development of CCOS appears to have contributed to a rapprochement between wards and critical care units. This has worked in both directions - from the perspective of the wards, the critical care unit is no longer a mysterious black box, whereas from the perspective of the critical care unit, there is enhanced understanding of the pressures on ward staff. The original meaning of “critical care without walls” was related to clinical objectives which have been only partially achieved. Yet, the aspiration of “critical care without walls” also has a valid organisational and social meaning about which there is considerable evidence of achievement.

Conclusions

The low sensitivity of existing TTs means that a high number of patients with established critical illness requiring intervention were likely to be missed if ward staff relied solely on these for identifying deteriorating patients. It may be possible to increase the sensitivity, at the cost of increased workload, by reducing trigger thresholds. TTs will never provide 100% identification of critically ill patients (nor potentially critically ill patients) and should therefore always be used as an adjunct to clinical judgment and experience. Our results suggested that accurate use of a TT and response algorithm may improve the pathway of care for the recognition and management of the acutely ill patient on the ward, both prior to and post-admission to a critical care unit.

CCOS form a spectrum of different service models across the NHS and are, therefore, complex interventions making evaluation difficult. CCOS appear to fill gaps according to local need and “one size may not fit all”. Perhaps pragmatically, “best fit” for local needs has predominated.

Despite precise service models varying, the underlying principles are the same. The objectives of CCOS are to improve the quality of acute patient care and

experience. Despite the introduction of CCOS into the NHS without any provision for a concurrent evaluation (and thereby preventing robust evaluation within an RCT), our more limited, yet rigorous, non-randomised evaluation suggested, both quantitatively and qualitatively, some positive effects. However, no clear characteristics of what should form the optimal CCOS could be identified.

Though not an original aim for CCOS, they facilitate connectivity, reduce communication difficulties and enhance the delivery of care across organisational, professional and speciality boundaries and may, in this way, create an important culture change leading to improved quality of care, that is, improved recognition of acute deterioration, initial management and escalation of treatment. CCOS also appear to have made a siginificant impact on morale, career development, ward staff clinical skills, confidence levels, education and training. However, ultimate management of the critically ill should be the responsibility of those who have the appropriate knowledge and experience.

Recommendations for further research:

CCOS activities and workload depend on the CCOS being alerted at the right time to the right patient. Therefore, research on CCOS should focus, first, on improved TTs.

Disclaimer

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Addendum

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