ResearchSummary

NHS National Institute for Health Research

Critical care outreach services in the NHS

Critical Care Outreach Services (CCOS) were introduced into the NHS to extend the services offered by critical care units to patients with potentially life-threatening illnesses elsewhere in the hospital. Complementing CCOS, many hospitals also introduced early warning scoring systems, called 'track and trigger' (TT) systems, to help staff identify deteriorating patients, at an early stage.

How good are TTs at detecting deterioration? What are the benefits of CCOS? And, are patients who receive these services less likely to die or suffer subsequent problems as a result of their critical illness? This summary presents the results of a programme of research that addresses these questions.

It was commissioned by the NIHR Service Delivery and Organisation Programme (SDO) and led by Dr Kathryn Rowan at the Intensive Care National Audit & Research Centre (ICNARC).

It will interest critical care staff, other clinical and managerial hospital staff, trust executives, patients, their families and friends.

Key findings

Track and trigger systems (TTs)

- The ability of TTs to detect established critical illness is low.
- TTs need improving and should be used only as an adjunct to clinical judgement.
- Staff must be trained and supported to use them.

Critical care outreach services (CCOS)

- CCOS visits *before* admission to critical care are linked to a significant decrease in cardiac arrest during the 24-hours before admission.
- They are also linked to longer-pre-admission hospital and critical care unit stays.
- CCOS visits *after* discharge from critical care are linked with lower hospital mortality, a shorter hospital stay and lower readmission rates.
- CCOS visits *after* discharge appear to be cost-effective.
- CCOS reduce communication difficulties and enhance delivery of care across organisational, professional and speciality boundaries.

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Background

The increasing complexity of treatments combined with growing numbers of older people and trends towards shorter hospital stays mean that, today, patients on hospital wards are sicker and potentially more at risk of becoming critically ill.

To meet patient needs, a variety of early warning systems or track and trigger systems (TTs) have been developed to alert ward staff to physiological clues that a patient's condition is worsening (see box). It is not known which is best at detecting patients with potential or established critical illness.

In 2000 the document, *Comprehensive Critical Care* (DH, 2000), promoted the development of critical care outreach services (CCOS) in the NHS to improve both the quality of care critically ill patients receive and outcomes. CCOS are specialised teams usually led by a senior critical care nurse. There was no set model for CCOS and hospitals were encouraged to develop their own services tailored to local needs.

CCOS goals are:

- To avert admissions or ensure timely admission to the critical care unit
- To support continuing recovery by easing patients' transition from the critical care unit to the general ward
- To share skills with ward staff.

The programme of research reported here examined the impact of these two initiatives on the organisation, delivery and outcomes of care for critically ill patients, highlighting policy implications and gaps in knowledge.

What is a TT?

TTs are designed to measure regularly ('track') vital physiological signs – such as breathing, heart rate, blood pressure and level of consciousness – that might suggest deterioration. When a certain score or threshold is reached on one or more of these (the 'trigger'), this signals that it is time to call more experienced staff to the patient's bedside as a matter of urgency.

Practical findings

Track and trigger systems – TTs

A national postal survey of 191 responding acute NHS hospitals in England found that 73% had a formal CCOS. Of these, almost all – 96% – used a TT on adult wards.

The survey found the following:

- Many different TTs are in widespread use
- Most hospitals – 86% – only used one TT but some used more
- The most common vital signs recorded were breathing rate, heart rate, blood pressure and level of consciousness
- In 70% of hospitals, a TT was used on all adult wards
- Most hospitals with a TT – 73% – used it on all patients
- The rest used a variety of ways to determine when to use the TT. These ranged from staff concern to a request by the CCOS. Over half the hospitals completed the TT alongside other routine observations
- Most hospitals reported that more than one member of staff was to be notified in the event of a TT trigger. The time this member of staff took to respond varied according to level of risk but was usually within 30 minutes.

How accurate were TTs?

A quantitative evaluation of data from 15 TTs found that, by and large, they were not highly accurate in identifying patients with established critical illness. Specifically, they only identified 43% of patients who had deteriorated to the point of established critical illness. Moreover, there was wide variation in accuracy across hospitals.

Qualitative findings

The quantitative studies were supported by a qualitative evaluation of TTs involving 115 interviews with 122 staff. This revealed that members of CCOS teams felt that patients were identified sooner and treated better, where TT scores were completed and interpreted accurately. However, the researcher frequently witnessed examples of extremely sick patients on general wards being identified only when a CCOS nurse came onto the ward.

Local issues

A number of local issues appeared to affect accuracy. These included:

- lack, or poor use, of TTs in some hospital areas
- variation in use among staff
- poor data collection and interpretation.

Some nurses, especially those who were more experienced, admitted to not completing TTs on the grounds that they knew how to identify and judge when a sick patient needed more intensive treatment.

Practical difficulties, within and between medical teams, also hindered accuracy. Ward nurses, for example, often reported problems in contacting doctors or delays in doctors coming to see patients who had 'triggered'.

"It gives them (the nurses) a sort of quantifiable figure to think, well, that's wrong…"
G-grade nurse, critical care unit

What impact did TTs have?

Those interviewed were in favour of TTs, citing, in particular, their value in providing objective evidence that a patient was sick or deteriorating. This was especially useful for inexperienced or junior staff. Interviewees also highlighted the success of TTs in enabling ward staff to identify problems sooner and manage patients better, so that they did need to be admitted to the critical care unit. Some interviewees, however, feared that staff could, or had, become over reliant on TTs and cautioned that they should be regarded as a tool to help identify patients at risk *not* a replacement for clinical judgement.

"Training made me look and realise that I could do this. I got all my trigger scores and it taught me how to do fluid balance charts correctly and how to work out a positive and negative balance, which I didn't have a clue about before. All I knew was how to chart something and anything else I left to the nurses."
Health care assistant, ward

Education and training

Education and training were felt to be crucial for staff using TTs. Most ward staff felt that such education helped empower them and improved basic treatment. But, although most hospitals conducted formal and informal training, not all ran regular rolling sessions and this was seen as a failing. Moreover, few provided training for doctors, who were sometimes accused of not taking notice of TTs as they were unaware of their existence.

CCOS staff suggested that training did not always achieve what they had hoped for; although the reason for this was unclear. Some felt that apathy, or lack of motivation, on the part of ward nurses were, at least partially, to blame.

Many also felt that the educational role of the CCOS needed expansion. Ward nurses and physiotherapists, for example, were keen to have more education and training. CCOS members, however were concerned that, without regular training, ward staff could become deskilled and over reliant on specialists.

Critical care outreach services – CCOS

In a national postal survey of NHS acute hospitals – 73% – of the 191 hospitals that replied had a CCOS, the same proportion as a previous survey carried out by the Modernisation Agency in 2002. Of the 52 hospitals without a CCOS, seven had had one in the past. Six attributed their closure to lack of resources in terms of funding or staff, while the seventh had been stopped following a year's pilot. The services varied in terms of their objectives, but most – 85% – prioritised one of the three objectives laid down in *Comprehensive Critical Care* (see above).

How effective were CCOS?

A multi-centre before and after study was undertaken to explore the impact of CCOS at the critical care unit level in 108 units. This showed that the introduction of a formal CCOS was associated with significantly fewer patients receiving cardiopulmonary resuscitation (CPR) during the 24 hours prior to admission to the critical care unit. Fewer patients were admitted to the unit out-of-hours. And those who were admitted to the unit tended to be less severely ill. There was no effect, however, on the number of patients dying in the critical care unit, nor did having a formal CCOS appear to affect the number of patients who, having been discharged from the critical care unit, were readmitted.

A separate study explored the impact of visits by 55 CCOS at the patient level. The impact of visits from the CCOS were:

- Significantly fewer patients visited on one or more occasions by the CCOS *before* admission to the critical care unit had CPR prior to admission. They did, however, stay significantly longer in hospital before being admitted to critical care. They also stayed longer in the critical care unit.
- Patients who received one or more CCOS visits *after* being discharged from critical care stayed in hospital afterwards for a significantly shorter time.
- Significantly fewer patients, who received a CCOS visit within 48 hours of being discharged directly to the ward, died in hospital. Significantly fewer were readmitted to the critical care unit.

Interpreting the results

Caution is needed in attributing the above findings solely to cause and effect. For example, the lower rate of CPR in patients admitted to critical care units may have been because fewer cardiac arrests occurred as a result of earlier intervention. On the other hand it may have been that the arrest rate was the same but that staff attempted resuscitation less often as a result of more appropriate use of 'do not attempt resuscitation' (DNAR) decisions. Alternatively, it may have been that the same number of cardiac arrests and resuscitation attempts

took place, but fewer patients who had a cardiac arrest were admitted to critical care because CCOS deemed admission futile. It is most likely that some combination of all these contributed to the findings.

"We need to have the backing of everyone. We're a nursing team but we need the support of people like pharmacy, physiotherapists, our medical colleagues because we are all…striving for the same thing…So really, it's that bridging, bringing everyone together and working as a service for one outcome, which is the patient."
H-grade nurse, CCOS

Qualitative findings

A qualitative study was conducted to assess the impact of CCOS in acute NHS hospitals: 115 interviews with 122 individuals were carried out, including doctors, nurses and allied health professionals, managers, hospital chaplains, patients and their relatives.

Establishing CCOS

Most CCOS were set up as a result of national policy developments. Many of those who had set up CCOS initially met resistance from ward staff and doctors. Ward staff, for example, sometimes feared being judged or 'policed'. They also worried that CCOS staff would take over their roles. There were misperceptions too about the role of the CCOS and of CCOS nurses. Over time, however, as ward staff became more familiar with the CCOS and developed a relationship with the CCOS team these concerns eased.

The most important impact of CCOS was perceived to be its educational role – both in terms of training ward staff and sharing skills on the wards.

"You need very good communication. I mean you never get everybody on board but I think you have to have the key players on board, because, if you get hostility from the physicians, medics or divisions, you're going to have a real uphill struggle for quite a long time."
Matron, CCOS

Improved relations

The development of CCOS appeared to have improved relations between ward and critical care unit staff. For example, ward staff valued the support and back up that CCOS staff provided:

- in teaching them new skills or helping refresh old ones
- in helping familiarise them with the use of specialist equipment
- in giving advice and reassurance.

CCOS also helped bridge gaps between medical staff and ward nurses. Other positive benefits included reassurance and empowerment of ward nurses, confidence building, improved patient care, improved assessment and triage, and increased multidisciplinary working.

Trouble-shooting

CCOS were seen as valuable in helping to identify and sort out problems and issues, helping ward staff to gain access to doctors or referrals to critical care, and in backing up ward nurses. Those interviewed praised CCOS staff for:

- taking the fear out of receiving patients from the critical care or high dependency unit back onto the ward
- responding at the right time when called (especially when doctors were unavailable or unresponsive)
- providing support and information to wards with staff shortages or different mixes of skills
- making communication with doctors easier.

Factors for success

Success depended largely upon good communication between CCOS staff and ward staff, while poor communication was a significant barrier. The visibility of CCOS, the support of senior staff, hospital-wide collaboration, team leadership and resources were also critical.

Staff concerns

Some staff felt that CCOS had had no – or even a negative – impact, although many of the concerns they raised were hypothetical rather than real. Some expressed fears, for instance, that CCOS staff might 'take over' care of seriously ill patients resulting in ward staff and junior doctors becoming deskilled. Others feared that the presence of a CCOS might lead to over-dependency. Lack of skills on the part of ward staff, poor communication between ward nurses or between nurses and doctors or between ward staff and the CCOS may have contributed to lack of expected impact.

Positive effects

On the whole, however, the development of CCOS was seen as positive, particularly in helping to change relationships between wards and the critical care unit, demystifying the critical care unit and enhancing understanding of wards on the part of critical care staff. All of these are vital to break down barriers between different staff and areas of the hospital to create 'critical care without walls.'

What did patients think?

As far as patients and their families were concerned the main value of CCOS was the reassurance – both physical and psychological that they provided. This included providing specialist knowledge and information.

Conclusions

The accurate use of a TT with a clear mandate for experienced staff to respond to a trigger may improve the recognition and management of critically ill patients on wards. Until further evidence emerges as to which TT is best, however, hospitals should choose a TT that most suits their local needs.

For TTs to succeed, staff must be trained and competent in their use, must complete observations regularly and fully, and calculate scores accurately. The precise observations needed and how often they are recorded must be clearly spelt out.

Even with these caveats, TTs will never be foolproof and should only ever be seen as an aid to clinical judgement, in order that patients with critical illness are not missed. There should be ongoing audit of their performance with results shared nationally.

With regard to CCOS, these were introduced into the NHS, despite little hard evidence for their benefit, and without any provision being made for ongoing evaluation. This meant that the opportunity to conduct a randomised controlled trial to evaluate their effectiveness was lost. Nonetheless, the more limited, yet rigorous, non-randomised evaluation reported in this summary did identify some positive, quantifiable benefits.

CCOS come in many different shapes and sizes and it is probable that there is no 'one size fits all'. In the absence of a clear model for care delivery, for patients with potential or established critical illness on wards, CCOS activities should continue in all adult, acute hospital settings. As for TTs, hospitals should adopt the model best suited to local needs. The responsibility for caring for patients who are, or are at risk of, becoming critically ill, however, should always be shared with those with appropriate knowledge and experience.

Future research

- The activities and workload of CCOS depend on services being alerted at the right time to the right patient. This is why future research must focus, initially, on improving the accuracy of TTs. This should include developing accurate outcome measures for *potential*, and not just established, critical illness. Once these exist, a prospective study to identify the best TT should be conducted. This should collect new data, rather than relying on existing NHS hospital audit data, preferably from hospitals not previously using TTs.
- When the best TT has been identified it should be tested in a range of different patient populations and in different hospital settings.
- In evaluating TTs in future, the use of recent, hand-held, electronic technologies for monitoring vital signs and other data should be considered as a way of improving both recording of data and triggering.
- As far as CCOS are concerned future research should be aimed at understanding better how their impact could be optimised. This could be achieved by a systematic study of when and how CCOS activities fail, and why.
- If such research identified an optimal model for CCOS, evaluation – preferably in the form of an RCT comparing this model of service delivery with existing models – could be considered. This should include an analysis of the relative costs of delivery.
- Although such a trial would inevitably be complex and expensive to design it would be invaluable in providing answers that the research studies reported here were unable to give.
- The recently released NICE guidelines on the recognition of, and response to, acute illness in adults in hospital, should lead to all local relevant policies, systems and procedures being reviewed.

About the study

The study was a multidisciplinary, mixed-methods evaluation of TTs and CCOS in the NHS consisting of seven linked sub-studies.

Evaluation of TTs

Study	Purpose
1. A systematic review of studies covering the range of TTs	To explore the extent of their development and testing relative to methodological quality standards
2. A descriptive national survey covering the introduction and use of TTs across acute NHS Trusts in England	To describe the development, introduction and implementation of TTs
3. An analysis of available TT data of suitable quality from NHS hospitals in England	To review all aspects of accuracy of TTs
4. A single-centre inter and intra-rater reliability study of the more common TTs	To investigate the reproducibility of TT measurements either when done by the same person twice or by different people with different levels of clinical experience
5. A qualitative evaluation	To elicit a wide range of stakeholders' views on TTs

Evaluation of CCOS

Study	Purpose
1. A systematic review of evaluative studies of CCOS	To explore the evidence for the impact of CCOS
2. A descriptive national survey covering the introduction, implementation and current models of CCOS across acute NHS hospitals in England	To describe the development, introduction, implementation and current models of CCOS
3. A before and after study of the impact of the introduction of CCOS on critical care admissions	To explore the impact of CCOS on critical care unit admissions
4. A matched cohort analysis of critical care patients	To evaluate the impact of CCOS
5. A qualitative evaluation	To characterise the impact of the introduction, development and current models of CCOS within acute NHS Trusts in England.

Note: One survey and one qualitative study were conducted combining evaluation of TTs and CCOS

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Further information

The full report, this research summary and details of current SDO research in the field can be downloaded at: www.sdo.lshtm.ac.uk

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Feedback

The SDO programme welcomes your feedback on this research summary. To tell us your views, please complete our online survey, available at: www.sdo.lshtm.ac.uk/researchsummaries.html

About the SDO Programme

The Service Delivery and Organisation Programme (SDO) is part of the National Institute for Health Research (NIHR). The NIHR SDO Programme is funded by the Department of Health.

The NIHR SDO Programme improves health outcomes for people by:

- commissioning research and producing research evidence that improves practice in relation to the organisation and delivery of health care; and
- building capacity to carry out research amongst those who manage, organise and deliver services and improve their understanding of research literature and how to use research evidence.

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Addendum

This document was published by the National Coordinating Centre for the Service Delivery and Organisation (NCCSDO) research programme, managed by the London School of Hygiene & Tropical Medicine.

The management of the Service Delivery and Organisation (SDO) programme has now transferred to the National Institute for Health Research Evaluations, Trials and Studies Coordinating Centre (NETSCC) based at the University of Southampton. Prior to April 2009, NETSCC had no involvement in the commissioning or production of this document and therefore we may not be able to comment on the background or technical detail of this document. Should you have any queries please contact sdo@southampton.ac.uk.