There is another way: empowering frontline staff caring for acutely unwell adults

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Abstract

Quality problem or issue. It is estimated that only 17% of patients survive an in-hospital cardiac arrest. Medical evidence indicates that many patients show signs of deterioration during the 24 h period prior to their cardiac arrest.

Initial assessment. At Salford Royal NHS Foundation Trust (SRFT) 135 patients (outside critical care areas) suffered a cardiac arrest between March 2007 and April 2008.

Choice of solution. Quality improvement method—The breakthrough series (BTS) collaborative approach, change package—reliable manual vital signs, nurse-led response to the deteriorating patient, code red, structured ward round, ceilings of care, nurse-led do not attempt cardiopulmonary resuscitation (DNA-CPR) protocol and allocated roles.

Implementation. The project was delivered over two phases with a total of 23 wards (12 wards in Phase One and 11 wards in Phase Two). Frontline teams worked to develop changes with the aim of reducing cardiac arrests by 50%.

Evaluation. The primary outcome measure was the number of cardiac arrests per 1000 admissions outside of critical care areas. Process and balancing measures were also used to evaluate the impact of the intervention.

Lessons learned. The results showed a positive relationship between the change package and a reduction of 41% in cardiac arrests outside of critical care areas from the baseline period (April 2007–March 2008) to December 2012. The BTS model has the potential to reduce cardiac arrests without the need for initial large-scale financial investment.

Keywords: quality measurement, quality improvement, adverse events, cardiac arrests, patient safety, hospital care

Quality problem: caring for the acutely unwell adult

It is estimated that only 17% of patients survive an in-hospital cardiac arrest [1]. Medical evidence indicates that many patients show signs of deterioration during the 24 h prior to their cardiac arrest [2, 3]. Patients on general adult wards and emergency departments who are seen to be at risk of deteriorating may be identified before a serious adverse event. This identification is typically through monitoring changes in physiological observations, which is of crucial importance when trying to minimize serious adverse events, such as cardiac arrests and death [4]. Research has shown that patients who become, or who are at risk of becoming acutely unwell on general hospital wards often receive suboptimal care prior to admission to an intensive care unit [5–7]. Furthermore, studies have shown that patient mortality increases with the number of physiological abnormalities \((P < 0.001)\) (0.7% with no abnormalities, 4.4% with one, 9.2% with two and 21.3% with three or more) [8]. These findings highlight the importance of frequent and accurate observations of in-patients to ensure that they are receiving appropriate and timely care and treatment. Early detection of deterioration and early intervention to prevent further deterioration and cardiac arrests are essential for effective, quality patient care. Early assessment although being the expected standard of care, is rarely the norm [9].

Medical literature suggests that in order to reduce cardiac arrests, organizations can adopt a rapid response team (RRT) also referred to as a medical emergency team (MET). These teams of clinicians bring critical care expertise to the patient’s bedside (or wherever it is needed). An increasing number of hospitals are embracing METs because of the perceived strong
theoretical benefits; however, there is a high level of controversy and debate surrounding the efficacy of METs on patient outcomes. A recent review of the literature found that there was moderate-to-strong evidence that METs are associated with decreased mortality and cardiac arrest rates, but weaker evidence on reducing ICU admission rates [10]. In contrast, a study by Chan et al. [11] concluded that although RRTs [rapid-response team] have broad appeal, robust evidence to support their effectiveness in reducing hospital mortality is lacking. In addition to the problems relating to a lack of evidence, RRTs or METs typically require an outlay of expenditure, both at the start of the programme to establish the team and on-going expenditure if new posts are required [12].

**Initial assessment**

The project took place at Salford Royal NHS Foundation Trust (SRFT), a university teaching hospital in the North West of England with ~800 in-patient beds, day case, out-patient, diagnostic and a range of adult and children's community services. At SRFT 135 patients (outside critical care areas) suffered a cardiac arrest between April 2007 and March 2008 yielding a calculated cardiac arrest rate outside of critical care units of 1.28 per 1000 admissions. This was within the reported range of between 1 and 5 per 1000 admissions in Western countries [13]. However, we saw an opportunity to make further improvements to the care of the acutely unwell adult.

Figure 1 highlights some of the key issues which SRFT was facing relating to cardiac arrests. The Governance Team at SRFT identified the volume and nature of cardiac arrests as a patient safety incident. The team identified multiple system failings that resulted in a patient suffering a cardiac arrest. These failings could be categorized into four areas: failure to recognize the deteriorating patient [2], failure to respond appropriately to that patient [14], failure of communication between health-care staff [15] and insufficient, delayed or incorrect medical care [16].

**Choice of solution**

To reduce in-hospital cardiac arrest, we chose to develop, test and implement an acutely unwell adult change package using quality improvement methodology and a breakthrough series (BTS) collaborative delivered in two phases.

A BTS [17] collaborative approach was adopted in which teams were able to learn from each other and from local experts, around a focused set of objectives. A BTS approach centres on bringing together individual teams/wards for a 6–15-month period to focus on an improvement topic. The BTS approach comprises three learning sessions and a final summit, in between which there are action periods where the teams carry out Plan Do Study Act (PDSA) cycles. This approach empowered staff to examine the processes in place in their individual clinical areas and to make improvements to patient care that they felt were appropriate and relevant.

The acutely unwell adult (AUA) project team approached the ethics committee at the start of the programme. The chair of the Local Research Ethics Committee confirmed that as the programme was service evaluation and not research, the project did not require ethical approval.

Twelve wards were identified for the first phase of the programme and a further 11 wards for the second phase. The Phase One wards were chosen because of their high numbers of cardiac arrests (rather than high rates). We reasoned that these wards had more experience with cardiac arrests and that the impact of interventions intended to reduce arrests would be seen more readily.

The programme was managed by a steering group of experts, which included health-care professionals from the fields of emergency medicine, critical care, anaesthetics, general medicine, surgery, elderly care and resuscitation training, QI advisors and the executive sponsor (the Executive Nurse Director) of the collaborative. The group met prior to the first learning session to review the available evidence and to develop the project driver diagram (see Fig. 2). The driver diagram articulated the aim of the project and the main areas of work (primary drivers) required to achieve it. Each primary driver had multiple smaller work streams (secondary drivers) in which teams focus their efforts. The driver diagram ensured that every participant understood the aim of the project and how to achieve the overall aim.

Three learning sessions were held throughout each phase of the programme. Representatives attended the learning sessions and coordinated ward improvement efforts. Teams were multi-professional, including junior and senior nurses, health-care support workers, physiotherapists and doctors. Learning session 1 (LS1) provided teams with instruction in the theory and practice of improvement and background information around the project aim. LS1 was also used to present the local situation, including the arrest data for individual wards, and the evidence around ‘best practice’. Participants were introduced to The Model for Improvement, which is a simple, yet powerful tool for accelerating improvement. Each phase was concluded with a summit which celebrated success and looked at future work.

**Implementation**

The aim of the wards participating in the collaborative was to test changes to improve the care of the acutely unwell adult. It was imperative that we did not compromise the care of the acutely unwell adult and that any changes, which were deemed appropriate, were implemented in the wards not participating in the collaborative. As a result of this decision, elements of the AUA change package were spread throughout the whole organization before the formal spread of the programme.

Between learning sessions ward teams tested changes using PDSA cycles. Some wards ran multiple tests of change between sessions and subsequently analysed results prior to the following learning session. The project director and project manager visited pilot wards on a weekly basis to provide improvement support. The project also developed an extranet where wards could post information and share data, the purpose of the extranet was to aid collaboration between learning sessions.

The teams tested a number of changes throughout the project period. Changes that resulted in improvements in
practice and patient care were adopted as part of the change package. The change package comprised seven changes (listed below).

Reliable manual observations: the Trust stopped using electronic sphygmomanometers and moved to manual observations.

Figure 1 Acutely unwell adult (AUA) timeline.

Figure 2 Driver diagram.
Nurse-led response: all patients receive an appropriate response to a raised early warning score and nursing staff utilize their skills to optimize care for patients.

Allocation of roles: allocated roles discussed and assigned at the safety huddle at the beginning of each shift, each individual in the arrest team is given a certain role to follow in the event of an arrest and roles are recorded in the safety huddle document and displayed on a notice board.

Code red: any member of staff, including domestics, porters and ward visitors, concerned about a patient can declare a ‘code red’ and all staff on the ward are made aware of patients ‘at risk’.

Structured ward round: The use of the structured ward round check list so that medical teams assess patients in a robust and replicable manner.

Ceilings of care: recognizing that an acutely unwell patient may be reaching the end of their life, to ensure that all staff provide dignified and compassionate care.

Nurse led DNA-CPR: nurses often know when patients are reaching the end of life as they have intense patient contact. The nurse makes a referral to the consultant and a joint review is made on the ward round, patients can then be placed on DNA-CPR, which is recorded in the notes and communicated to the team.

The two examples that follow show specifically how the AUA programme has been developed with regard to manual observations and code red.

**Manual observations**

The teams testing manual observations found that manual recordings were an accurate method of obtaining and recording patient information. In addition, staff found that when they were taking blood pressure manually they also had an opportunity to check the patient’s pulse and touch the patient’s skin. Staff testing the change felt that the manual recording of vital signs in acutely unwell patients was recommended; as conventional touch and feel in nursing care helps to ensure that any decline in the patient’s condition is acted upon appropriately, thereby providing prompt treatment. Initial testing demonstrated no difference in obtaining the readings by both methods. In fact, the nursing staff felt that it was more meaningful conducting manual observations as they spent more time with the patient.

Following the testing period, manual observations were adopted across the Trust. This change was carried out across the hospital, so that all wards were conducting patient observations in the same way. All members of staff were provided with appropriate training to ensure that patient care was not compromised and that all patients were observed in the same way.

**Code red**

The rationale behind code red was to make all staff aware of patients at risk of deterioration (see Fig. 3).

Any member of staff, including domestics, porters and ward visitors concerned about a patient were able to declare a ‘code red’. Alerting housekeepers and domestic staff to code red is important as it empowers staff to alert medical and nursing staff to a patient who has deteriorated. Housekeepers and domestics are often constants on the ward and potentially they are perfectly placed to alert staff if they have concerns that the patient is deteriorating.

**Evaluation**

To assess improvement, we used a time-series design in which groups of participants were observed repeatedly before, during and after the intervention, examining change relating to key outcome, process and balancing measures. The Institute for Healthcare Improvement (www.ihi.org) defines these as follows:

1. **Outcome measures**: these measures tell you if changes are actually leading to improvement.
(2) Process measures: these measures tell you if you are implementing actions that are expected to improve the outcome measure.

(3) Balancing measures: these measures tell you if changes to improve one part of the system are causing new problems in other parts of the system.

Data were analysed as time-series data using a simple run or control chart, which can display graphically a project’s results on an on-going basis [18, 19].

**Primary outcome measure**

The primary outcome measure was the total number of arrests per 1000 admissions outside of critical care units. Rates of cardiac arrests were calculated using the denominator of admissions for all patients, i.e. the total number of admissions to the hospital. Admissions were calculated from an administrative database (business objects). These data were used to derive the denominators for the rate. The percentage reduction in cardiac arrests was calculated by comparing the cases per 1000 admissions during the baseline period (2007–08) and Phase One (2008–09) and Phase Two (2009–10). The rate takes into account the number of admissions to the hospital and as such will show the number of cardiac arrests in relation to the level of hospital activity.

Cardiac arrest calls were collected via the switchboard and reported to the AUA project team. The resuscitation department then validated data via cross reference with the resuscitation team leader. Only cardiac arrests were reported and not simply cardiac arrest calls. Additional data were also collected through reviewing 20 patient records, selected at random. The records were reviewed for early warning score (EWS) completion and so reviewers were able to check that EWS had been completed and totalled correctly. As cardiac arrests are unpredictable events, we used a Poisson analysis to calculate 95% confidence limits.

**Process and balancing measures**

To investigate the impact of the change package on care, we collected data on a number of process measures, such as the number of observations completed, confidence of staff caring for acutely unwell adults and patients placed on the ‘care of the dying’ pathway. DNA-CPR orders were examined from a process and balancing measure perspective. It was important to examine that appropriate care was provided for acutely unwell patients and that they were being appropriately managed. Placing appropriate patients on a DNA-CPR order was viewed as a way of ensuring that patients care was managed effectively; however, it was also important to ensure that patients were not being put on a DNA-CPR order to reduce the resuscitation calls.

Staff confidence was measured by collecting data via a survey with a sample of staff from the collaborative wards. Staff were asked to state overall how confident they were in dealing with acutely unwell patients and were provided with a Likert scale from 1 to 10. Ten wards were randomly chosen and two qualified members of staff were asked to complete the survey. The AUA team devised a number of questions to check respondent’s knowledge of caring for the acutely unwell adult. These questions required respondents to have specific knowledge.

To ensure that the changes implemented by the project were not having a negative impact on other areas of the organization, a balancing measure was included that examined unscheduled admissions to critical care. This was investigated as the project outcome measure was cardiac arrests outside of critical care units; therefore, it was important that we examined the health status of patients in critical care units to ensure that there was not an increased number of patients being moved to ICU and as such would not be counted.

**Results**

The cardiac arrest rate outside of units was 1.28 (LCL 0.13 to UCL 2.42) over the baseline period (April 2007–March 2008) per 1000 admissions. Following the start of the project in April 2008 (Phase One) this reduced to 0.91 (LCL 0.00 to UCL 1.53) per 1000 admissions. From January 2009 (start of Phase Two) this improvement was maintained and then further sustained improvement is seen following the scale up and spread of the change package throughout the organization with an arrest rate of 0.53 (LCL 0.00 to UCL 1.19) per 1000 admissions. This equates to a 41% reduction in cardiac arrests from baseline rates (see Fig. 4).

Figure 5 demonstrates that there was not a significant change in the volume of DNA-CPR orders across the pilot wards from 2007 to 2009. This would suggest that the reduction in cardiac arrests was not caused by more patients being given a DNA-CPR order and therefore less calls to the resuscitation team.

The staff survey results showed that the percentage of staff who felt confident treating acutely unwell adults did not appear to increase or decrease over the duration of the programme. We observed that even when respondents expressed confidence in caring for the acutely unwell adult, they did not always answer the detailed knowledge questions correctly. This finding might be due to staff feeling over confident at the start of the programme.

Figure 6 shows the percentage of unplanned admissions to ICU who survived to hospital discharge. This chart shows that there has not been a significant change in unplanned admissions to ICU surviving to hospital discharge. In addition, we looked at the per cent of unplanned admissions to ICU from wards. The data showed that there had not been an increase in the per cent of unplanned admissions from wards, which indicates that the reduced arrest rate was not caused by more patients making unscheduled transfers to a higher level of care.

**Lessons learned**

The AUA project found that empowering staff to design changes to clinical practice was a positive, efficient way of
reducing cardiac arrests, while emphasizing the importance of taking a collaborative approach and involving all staff in caring for the acutely unwell adult.

The longitudinal data and our knowledge of the organization suggest that the change package has had a positive impact on reducing cardiac arrests. Over the time period of the

Figure 4  Arrest rate (outside of units) per 1000 admissions.

Figure 5  Count of DNA-CPR orders.
programme, the organization’s case mix did not change and we did not introduce any new specialities. Furthermore, the DNA-CPR data did not show any difference before and after programme, nor was there an increase in ICU mortality.

The programme was initially developed across collaborative wards to test changes in specific areas; however, these changes were quickly adopted throughout the organization, which resulted in the Trust-wide reduction of cardiac arrests. The non-collaborative wards did not use the BTS methodology, i.e. testing new ideas for change; they solely adopted the change package which was developed by the collaborative wards. This illustrates the success of the BTS model to develop a change package which is clear and easy to use, whereby health-care professionals are able to adopt changes relatively quickly and easily. The ease of use is a result of the effective tests of change, which were carried out by the collaborative wards.

There are few studies that show improvement in actual patient outcomes (e.g. survival to hospital discharge) with improvements in delivery of high-quality CPR. Recognizing the importance of both technical and non-technical skills (human factors) to deliver high-quality CPR is essential [20]. A review of the literature found that 89% of respondents reported that there was room for improvement in resuscitation practice at their institution, concluding that there is wide variability in resuscitation practices across US hospitals [21]. The allocated roles section of the change package is a key element to facilitate the improvement of resuscitation practice and as such is an important finding from this project. Furthermore, a review of the literature found that many MET studies do not include patients whose status was changed to DNR as the outcome criteria for mortality figures [22]. The study reported in this paper examined DNA-CPR orders and found that orders had not increased as an outcome of the programme.

The elements of the AUA change package were rolled out simultaneously, not sequentially and so it is difficult to demonstrate which parts of the change package were most successful. We developed the work in this way as the aim was to produce a holistic change package, rather than individual items. This is the benefit of the AUA change package as it provides health-care professionals with a package that they can adopt, rather than one or two tested changes.

SRFT is now building on this work to ensure that any cardiac arrest which occurs in the Trust is examined in detail and, in the majority of occasions, viewed as a system failure. The review of each arrest is carried out at the directorate level and these results are then reviewed and presented to the teams at learning and divisional meetings. The focus is on a multidisciplinary review and identification of system faults that require improvement. Each cardiac arrest is subjected to this level of scrutiny to ensure that improvements to patient care and patient safety are made as and when required. It is of note that these reviews continue to show that in the preceding period, prior to the arrest, one or more elements of the bundle were not implemented effectively, further strengthening the idea that reliable implementation of the change package can further reduce arrest rates.

From initial review of the measurements, the AUA team concluded that communication between health-care professionals around the care of the deteriorating patient is an area which will continue to be developed. The AUA programme has only been possible due to the culture change which has

Figure 6 Unplanned admissions to ICU—survived to discharge.
occurred at SRFT, where cardiac arrests are viewed as a system error, rather than an everyday event. This culture change would have been difficult without the implementation of the AUA quality improvement programme. The reduction in cardiac arrests, which has been sustained following the programme, illustrates the efficacy of the change package.

References