

Design and Implementation of a Trauma Care Bundle at a Community Hospital

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ABSTRACT

The Niagara Health System (NHS) in Ontario, Canada is comprised of three non-designated trauma center (NTC) hospitals which provide primary care to approximately 100 trauma patients annually. NTCs often lack standardized resources such as trauma surgeons, trauma-trained emergency room physicians, Advanced Trauma Life Support certified staff, trauma protocols, and other resources commonly found at designated trauma centers. Studies indicate that these differences contribute to poorer outcomes for trauma patients treated at community hospitals in Ontario, including the NTC hospitals of the NHS. In other settings healthcare checklists and bundles have proven effective in streamlining processes to ensure effective, efficient and timely patient care.

Quality Improvement (QI) tools and methods were used to design, implement, and evaluate a trauma care bundle at one of the NHS's community hospitals. We assessed outcome and process measures through a chart audit of all trauma care patients in the NHS from July 2015 - November 2015. A Safety Attitudes Questionnaire (SAQ) was administered to health system staff who were involved in the pilot to assess balancing measures. Between July-November 2015, 39 patients were treated at the St. Catharines Hospital that were identified as either Canadian Triage and Acuity Scale (CTAS) I or CTAS II trauma patients. Of those 39 major trauma patients, 15 received care using the trauma care bundle, representing a 38% uptake. Patients who received care with the trauma bundle had an average Emergency Department (ED) length of stay (LOS) of 1.7 hours, compared with those patients in whom the bundle was not used, whose average ED LOS was 3.4 hours. The SAQ administered to ED physicians who used the bundle (n=10) highlighted the impact on ED patient safety. These early findings suggest that the bundle provides a substantial improvement to the current trauma care process within the Niagara Health System.

PROBLEM

A vital concept in the care of trauma patients is the “Golden Hour”, which is defined as the first 60 minutes after sustaining a traumatic injury. Effective care within this hour is

likely to have a significant impact on patient survival.¹ Due to the time-sensitive nature of traumatic injuries many patients are first treated at the nearest community hospital to ensure stabilization before transferring to a major trauma center. A 2012 Ontario study found that “under-triage” to community hospitals, which are also known as non-trauma centers (NTCs) within Ontario’s current exclusive trauma system, is associated with a 30% increase in mortality.² This suggests that trauma patients who receive initial care within the Niagara Health System (NHS), composed of three community (NTC) hospitals, may have significantly lower chances of survival compared to trauma patients who were transported directly to a designated trauma center. Despite this, the Niagara Health System experiences a consistent volume of approximately 100 trauma patients every year. Therefore, ensuring effective trauma care based on best practices, as well as the timely facilitation of patient transfer, is critical in ensuring optimal patient outcomes.³ The lack of standardized resources at NTC hospitals remain problematic. The aim of this quality improvement project was to improve the efficiency of trauma care in a NTC hospital by reducing the time from patient triage to patient leaving the ED by 25%, by the end of a 6-month pilot period.

BACKGROUND

The establishment of effective trauma systems and trauma care has become a global concern due to its large impact on mortality, long-term disability and financial costs.⁴ Current statistics on trauma in Canada estimate that approximately 200,000 Canadians sustain acute injuries every year, which translates to almost 20 million dollars in medical expenditures annually.⁵ A Canadian study demonstrated that over one-fifth of the population lives more than a one-hour drive from

a designated trauma center.⁵ As of 2012, there were 150 acute care hospitals classified as non-trauma centers in Ontario and only nine classified as designated trauma centers. These nine hospitals are largely located in densely populated cities across the province of Ontario, such as Toronto, Ottawa, and Hamilton.⁵ Despite the exclusive trauma system in Ontario, acute hospitals such as those in the NHS often provide preliminary care to trauma patients.⁶ These patients are usually stabilized and may undergo initial testing before being transferred to a designated trauma center. Higher mortality rates for trauma patients who receive initial care at community hospitals may be attributable to a lack of healthcare provider experience or certification (e.g. ATLS), a lack of resources, or a combination of these.⁷ Within the NHS, there are currently no trauma-specific resource tools, as opposed to designated trauma centers which often have various order sets and directives in place for trauma care.⁶

Within the Niagara Health System there are three hospitals with 24/7 Emergency Departments located in Niagara Falls, St. Catharines, and Welland.⁶ These hospitals are not considered designated trauma centers and therefore are not formally included in Ontario's exclusive trauma system.⁵ Despite this, patients who sustain a major traumatic injury within the Niagara region often receive preliminary care at an NHS hospital. For example, in the 2013-2014 fiscal year the NHS provided care to over 90 major trauma patients (CTAS I&II) before they were transferred to a designated trauma center. In 2012-2013 the NHS provided care for 100 trauma patients.⁶

Quality improvement (QI) projects can aid health care organizations in identifying issues in how they implement care, designing potential interventions, and implementing effective corrective measures.⁸ QI efforts in trauma care have proven effective in reducing patient mortality and morbidity outcomes, increasing staff safety culture, and reducing costs.³

Assessment of Problems

In assessing the problem through the lens of the six "Aims for Improvement" we identified several dimensions of healthcare quality in the NHS trauma care process that could be potentially improved through the successful implementation of a quality improvement initiative.⁹ In terms of healthcare safety, the poorer outcomes of trauma patients treated at community hospitals suggest some measure of unsafe care.² When considering effectiveness, there are trauma care resources that are used by designated trauma centers to aid the trauma care process, such as trauma-specific resuscitation records (Appendix B). While unmodified adoption of these tools may not be useful for community hospitals, an adapted version could improve the effectiveness of care. Similarly, the Trauma Care Checklist is intended to help the trauma team effectively prioritize interventions and investigations in a streamlined and evidence-based manner. As highlighted by the concept of the "Golden

Hour", timely trauma care is paramount to good patient outcomes.¹ In a NTC this will be most evident from studying the time spent in the community hospital prior to transfer to a designated Trauma Center. In addition to timeliness, the efficiency of the trauma care process must also be considered, as trauma patients demand a significant amount of staff time and attention. By focusing on essential steps in trauma resuscitation, the Trauma Care Checklist should enhance efficient care. Additionally, during the trauma care process there is the potential for the excess use of resources, such as the unnecessary use of diagnostic imaging, which must be considered. The last dimension of healthcare quality to consider in this scenario is the equity of care. The Ontario study suggested that the hospital in which trauma patients receive initial care can have a large effect on their outcome.² This points to an inequitable trauma care system in Ontario that can, in part, be solved by improving the trauma care processes at community hospitals such as those in the NHS. Particularly given the known geographical dispersal of the Canadian population, measures to improve trauma care outside major population centers will likely assume an increasing importance for public health nationally.

BASELINE MEASUREMENT

A pre-intervention analysis revealed that in 2013-2014, 42 trauma patients that were designated as CTAS I or II were treated at the St. Catharines hospital (Figure 1). Their combined average ED LOS at the St. Catharines site was 3.8 hours. Staff satisfaction with the current trauma care process was not collected pre-intervention. Instead, a safety attitudes questionnaire that gathered healthcare staff thoughts and opinions regarding the trauma care process before and after the introduction of the trauma care bundle was administered to staff post-intervention.

DESIGN

The WHO's establishment of the Guidelines for essential trauma care¹⁰ and the Guidelines for Quality Improvement Programmes⁴ support the use of a quality improvement method to improve the trauma care process for injured patients globally.³ Within our own trauma system, we felt that the disparity in patient outcomes between NTCs and trauma centres in Ontario represented a gap in patient care that could be improved by QI methods. We selected knowledge translation techniques, such as the implementation of checklists and protocols, as a potential way to improve the quality of care for trauma patients in the NHS.¹⁰ The pilot study used rapid cycle improvements, known as Plan-Do-Study-Act (PDSA) cycles, to progressively increase implementation of the trauma care bundle while undergoing continual assessment and modification. Record.

The World Health Organization (WHO) recently completed a pilot study to improve trauma care in several hospitals worldwide by implementing a trauma care checklist.¹¹ Checklists themselves are becoming commonplace in medicine because of their ability to standardize care and ensure health care staff remember important points in patient care.¹² These checklists are particularly important in complex, time-critical processes such as trauma resuscitation. Checklists also have the potential to enhance communication between the members of the trauma team as they provide multidisciplinary care to the injured patient. The intervention used in the present study consisted of a modified WHO Trauma Care Checklist and an Adult Trauma Nursing Resuscitation Record. Together these documents formed a trauma care bundle. The purpose of the WHO Trauma Care Checklist is to increase the efficiency and communication of the trauma team and enhance the systematic, evidence-based management of trauma patients. The purpose of the Adult Trauma Nursing Resuscitation Record is to increase standardization, enhance efficiency and completeness, in nurse-provided care of trauma patients, as well as to ensure optimal documentation of the trauma resuscitation.

STRATEGY

The aim of the first PDSA was to collect and review all data for major trauma patients (CTAS I&II) treated in the NHS from 2013-2014, and review literature on trauma care systems and trauma-related quality improvement initiatives. We had confidence that gathering this information would enable us to determine areas for improvement in regards to the trauma care process within the NHS, as well as identify evidence based tools and methodologies to facilitate these improvements. Analysis of 2013-2014 NHS data revealed that 42 trauma patients that were designated as CTAS I or II were treated at the St. Catharines hospital. Their combined average ED LOS at the St. Catharines site was 3.8 hours. Through the literature review, the WHO trauma care checklist was identified as an appropriate tool in improving the quality of trauma care within a hospital setting.¹¹ The Adult Trauma Nursing Resuscitation Record was identified as a useful tool through staff members who had used it in the care of trauma patients at St. Michael's Hospital. The literature review validated its value in standardizing care.¹² The trauma care checklist was adapted from a World Health Organization pilot project for major trauma care hospitals.¹¹ It was modified by a General Surgeon and the NHS Chief of Emergency medicine to better represent the needs of a community hospital. Specifically, question 14 was modified to reflect the potential for patients to be transferred which was not included in the original checklist (Appendix A). Question 16 was added to ensure that proper documentation was completed, promoting the successful transfer of patients through the CritiCall

system, Ontario's centralized inter-facility patient transfer system (Appendix A). The Adult Trauma Nursing Resuscitation Record was retrieved and modified from St. Michael's Hospital, a designated trauma center located in Toronto, Canada (Appendix B). These two documents were packaged together, creating a two-part Trauma Care Bundle. Nurse educators were informed of the bundle and a small number of nurses were introduced to the documents and trained in its use. The project physician lead, Dr. Doyle, work alongside nursing staff to increase comfort levels with the bundle and to promote the use of the bundle with 5 patients during a pilot period.

The aim of the second PDSA cycle was to pilot the trauma care bundle with 5 patients and collect feedback from participating physicians and nurses. Based on the literature review, it was hypothesized that the Trauma Care Bundle would positively impact the trauma care process, and staff feedback would allow for the identification of potential improvements towards the bundle, before increasing its implementation. After five patients had been treated using the trauma care bundle all participating staff were asked to fill out a short survey on their experience using the bundle in the process of caring for a trauma patient. Several questions were asked that required the nurses and physicians to reply on a 5-point Likert scale ranging from strongly disagree to strongly agree. There were also clarifying questions that allowed for written feedback and suggestions for improvements to the bundle. The initial feedback surveys highlighted a few major themes expressed by the healthcare professionals who used the bundle. First, the response to the bundle was mainly positive per most answers of "Agree" or "Strongly Agree". Some of the comments indicated that that the checklist was effective in ensuring that all steps in the trauma care process had been completed, that the bundle increased and improved communication between staff, and that the bundle organized patient assessment in an efficient manner. Despite these affirmative responses there were some areas of concern for the staff who used the bundle. By far the most frequently identified issue with the trauma care bundle was the formatting of the Trauma Nursing Resuscitation Record. Staff members commented that this fragmented the bundle and disturbed the flow. Staff also mentioned that the bundle could be better organized to facilitate the charting and documentation process during and after the care of the trauma patient. In response to this feedback our team has created a flowsheet version of the adult trauma resuscitation record which is similar to other documents used within the NHS. Healthcare staff suggested the use of a flowsheet because they have used it in other settings and have noted its positive impact. Minor modifications to the wording and formatting of the bundle documents were also introduced in response to the survey responses. Additionally, user responses identified that care would be made more efficient by including a blood

gas automatically in the trauma bloodwork panel within our electronic record. Overall the feedback surveys provided valuable input into improvements for the trauma care bundle while also validating its positive impact and encouraging further promotion and uptake. After this five-patient pilot, we further increased education and promotion of the trauma care bundle in collaboration with the nurse educators at the NHS. The Trauma Care Bundle was promoted to be used for every trauma patient at the St. Catharines Hospital.

The aim of the third PDSA cycle was to collect outcome, balancing, and process measures of the Trauma Care Bundle after a five-month pilot period. It was hypothesized that the Trauma Care Bundle would show positive impacts in all three areas of measurement. The main outcome measure of the trauma care bundle was the ED average length of stay. Chart audits were conducted from July–November 2015 for all CTAS I&II trauma patients treated at the SCS. This data was used to measure the outcome and process measures of the trauma care bundle. As discussed earlier, time is an important issue when treating critically injured patients.¹ Using the trauma care bundle it was hypothesized that the trauma care process would become more efficient, resulting in trauma patients spending less time in NHS emergency rooms. We assessed outcome measures by comparing the average (ED LOS) in trauma patients treated with the trauma care bundle and those trauma patients who were not treated with the trauma care bundle. Additionally, average times from “Triage to Registration”, “Registration to Physician Initial Assessment”, “Physician Initial Assessment to Disposition”, “Disposition to Left ED”, and “Triage to Left ED” were also analyzed and compared. As a process measure we calculated the proportion of trauma patients in the pilot period who received care with the trauma care bundle, indicating its uptake. We also determined whether the checklist and the adult resuscitation record had been initiated, partially completed, or fully completed.

It was important to ensure that the implementation of the trauma care bundle did not provide improvements to some areas of the trauma care process at the expense of other areas. Studies have shown that the implementation of standardization tools such as checklists are successful in improving the safety culture of medical staff.¹³ This improvement in safety culture has shown to be highly correlated with improvements in patient outcomes.¹⁴ Trauma patients represent a small sample of all the patients treated in the emergency departments of the NHS hospitals and therefore it would be difficult for an intervention targeted at this process to significantly affect the safety culture of the entire ED. However, we hypothesized that it could improve individual staff's safety attitudes in regards to the trauma care process. A Safety Attitudes Questionnaire (SAQ) from the Centre for Healthcare Quality & Safety website was used as a template to create a questionnaire specific for this project.¹⁵ It was modified using the Haynes et al., 2011

article as a model. The first section of the SAQ involved asking staff to answer 18 safety attitudes questions, nine specific to the trauma care process before the implementation of the trauma care bundle and nine specific to trauma care process when the trauma care bundle was used (Table 3). The second section asked staff six questions specific to the trauma care bundle itself and their overall satisfaction with it (Table 4). For staff to be considered eligible to complete the survey they were required to have participated in at least two incidents of trauma care in the last 6 months, once using the trauma care bundle and once when not.

The positive findings from the initial surveys were further supported by physician's responses to the SAQ which showed exclusively positive feedback. (Table 3 & Table 4) Physicians indicated that the trauma care bundle represented a significant improvement on several aspects of the existing trauma care process. The results suggest that the trauma care bundle was effective in improving collaboration between nurses and physicians, in decreasing communication breakdowns, and decreasing incidents of staff disregarding rules and guidelines (Table 3). Physicians also indicated that the trauma care bundle helped to reduce errors, improve patient safety and improve overall patient care (Table 4). Possibly the most striking result was that 100% of physicians indicated that if they were a patient being treated for a traumatic injury at the NHS, they would want the trauma care bundle to be used on them. This result seems even more significant when it is considered that most of these physicians have only used the trauma care bundle once or twice and yet they already recognize the significant improvement it has made on the existing trauma care process. Overall, the results of the SAQ indicate that the trauma care bundle provided improvement to staff's safety attitudes as it pertained to the trauma care process (See supplementary - Appendix A & B).

RESULTS

Within the pilot period of July–November 2015, 39 patients were treated at the St. Catharines Hospital that were designated as either CTAS I or CTAS II trauma patients. Of those 39 major trauma patients, 15 received care using the trauma care bundle, representing a 38% uptake. Of the 15 patients who did receive care with the trauma care bundle, the checklist was fully completed 73.3% of the time and the adult trauma resuscitation record was fully completed 40% of the time. In 20% of patients the checklist was partially completed and in 53.3% of patients the adult trauma resuscitation record was partially completed. In 6.7% of patients the checklist was not completed and again in 6.7% of patients the adult trauma resuscitation record was not completed (Table 1). The primary outcome measure was Emergency Department length of stay (Figure 2). Patients who received care without the trauma bundle had an average ED LOS of 3.4 hours, compared with

those patients that did receive care with the trauma care bundle who had an average ED LOS of 1.7 hours (Table 2). Notably, improvements were seen in the time from registration to initial assessment by the physician, from physician initial assessment to disposition, and from triage to left ED when they were transferred to a designated trauma center. A Safety Attitudes Questionnaire (SAQ) administered to ED physicians who used the bundle (n=10) highlighted the impact on ED patient safety as a balancing measure for consideration with the implementation of this trauma care bundle (Tables 3 and 4).

LESSONS AND LIMITATIONS

Comparing the average ED LOS times of trauma patients treated during the pilot period as an outcome measure we found times of 1.7 hours for trauma patients who received treatment with the trauma care bundle versus 3.4 hours for trauma patients who did not receive care with the trauma care bundle. This suggests that the trauma care process was substantially more efficient when the trauma care bundle was used. It should be noted that the 3.38 hours LOS of patients without the bundle was very similar to average ED LOS times in trauma patients treated at the St. Catharines hospital prior to our pilot (3.8 hours), which further suggests that the trauma care bundle was responsible for the improved efficiency.⁶ The most significant difference in average times was seen in “Physician Initial Assessment to Disposition”, where the trauma care bundle decreased the average time by 1.2 hours. This was as expected as this is the time when the trauma care bundle would be initiated and worked through. Overall, these results suggest that trauma care bundle was highly effective in improving the efficiency of the trauma care process within the St. Catharines hospital. Taken together, the average ED LOS and SAQ results indicate that the trauma care bundle provided a significant improvement to the existing trauma care process. These results promote the continued implementation of the trauma care bundle not only at the St. Catharines site, but also the other two hospitals of the NHS located in Welland and Niagara Falls.

During our pilot, uptake of the trauma bundle was 38%, far below a universal acceptance. While this value is not ideal it is also not entirely unexpected. Quality improvement projects involving the implementation of new tools and resources often struggle to foster buy-in from healthcare staff.¹⁶ We continue to work with NHS emergency room educators as well as NHS administration to enhance uptake as we roll out to all NHS sites, including a brief instructive video on appropriate completion of the trauma bundle and its expected benefits.

While the findings from the pilot were very promising there were several limitations of the study. We used average ED LOS as the main outcome measure as opposed to mortality or morbidity rates. The main reason for this decision was that 99% of trauma patients

treated within the NHS are transferred to a designated trauma center.⁶ Consequently, few patients suffer direct mortality or morbidity from their traumatic injuries during their brief time at the NHS. Due to the complexities, inherent in attributing causality to our limited intervention within this complex, multi-hospital treatment trajectory, we felt mortality would be a difficult endpoint to interpret reliably for our pilot study. In fact, the NHS emergency room mortality for our pilot study was zero. It was decided that for this QI project, an improvement in average ED LOS, as well as improvements in safety culture would be acceptable outcome measures. The marked improvements in these areas are valuable indicators on their own but also provide increased incentive to measure the impact of the trauma care bundle on patient mortality and morbidity. This data will be collected as the trauma care bundle continues to be implemented in the NHS.

An additional limitation of our pilot study is the small sample size for both the survey results and the chart audits. In the pilot period from July-November 2015 there were only 39 major trauma patients and of those only 15 received care with the trauma care bundle. This small sample did not allow for the data to be adjusted for potential confounding variables. This creates a difficulty in discerning whether the differences in average ED LOS were due to the trauma care bundle or other factors such as type of diagnosis, severity of injury, or attending physician. However, the initial suggestion from this study of both improved safety and efficiency strongly supports the increased implementation of the trauma care bundle at the NHS. This will create a larger sample size and allow for statistically significant data to be collected for further refinement of the tool in the future.

CONCLUSION

The shortened average ED LOS times and the positive SAQ results suggest that the trauma care bundle provides a substantial improvement to the efficiency and effectiveness of the existing trauma care process at the St. Catharines hospital. These findings support further implementation and monitoring of the trauma care bundle to all three sites of the NHS. The spread and scale of this bundle to the other sites of the Niagara Health System is ongoing. The successful implementation in the three NHS hospitals could be followed by the implementation into many other community hospitals across Ontario, further improving the outcomes of trauma patients across the province.

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Declaration of interests The authors have no conflicts of interests to declare.

Ethical approval Ethical approval was not required for this project as per Article 2.5 of the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans by the Government of Canada.

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