

A Multicenter Performance Improvement Program Uses Rural Trauma Filters for Benchmarking: An Evaluation of the Findings

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ABSTRACT

Colorado requires Level III and IV trauma centers to conduct a formal performance improvement program (PI), but provides limited support for program development. Trauma program managers and coordinators in rural facilities rarely have experience in the development or management of a PI program. As a result, rural trauma centers often face challenges in evaluating trauma outcomes adequately. Through a multidisciplinary outreach program, our Trauma System worked with a group of rural trauma centers to identify and define seven specific PI filters based on key program elements of rural trauma centers. This retrospective observational project sought to develop and examine these PI filters so as to enhance the review and evaluation of patient care. The project included 924 trauma patients from eight Level IV and one Level III trauma centers. Seven PI filters were retrospectively collected and analyzed by quarter in 2016: prehospital managed airway for patients with a Glasgow Coma Scale (GCS) score of less than 9;

adherence to trauma team activation criteria; evidence of physician team leader presence within 20 min of activation; patient with a GCS score less than 9 in the emergency department (ED): intubated in less than 20 min; ED length of stay (LOS) less than 4 hr from patient arrival to transfer; adherence to admission criteria; documentation of GCS on arrival, discharge, or with change of status. There was a significantly increasing compliance trend toward appropriate documentation of GCS (p trend < .001) and a significantly decreasing compliance trend for ED LOS of less than 4 hr (p trend = .04). Moving forward, these data will be used to develop compliance thresholds, to identify areas for improvement, and create corrective action plans as necessary.

Key Words

Benchmarking, Outcomes, Performance improvement, Process improvement, Rural trauma centers, Trauma centers

Rural trauma centers face a myriad of challenges in providing trauma care; they are isolated by vast geography and often lack advanced patient resources for high-acuity injuries (Byrnes et al., 2010; McSwain, Rotondo, Meade, & Duchesne, 2012; Soychak et al.,

2013; Vernberg & Rotondo, 2010; Whitney et al., 2010; Williams, Ehrlich, & Prescott, 2001). This is especially true in Colorado, which has an average elevation of 6,800 ft and areas open only seasonally, creating unique challenges for accessing health care (The Official Site of Colorado Tourism, n.d.). In addition, optimal patient care requires consistent trauma education and training, which can be a financial burden for many rural facilities (Byrnes et al., 2010; Williams et al., 2001). Furthermore, rural trauma centers are required by the Colorado Department of Health & Environment (n.d.) to develop and utilize a PI program to drive clinical care evaluation.

Trauma program managers and trauma nurse coordinators (TNCs) in rural facilities, however, have high staff turnover, with minimal resources and experience to develop or manage a PI program properly (Byrnes et al., 2010; Gade et al., 2008; Vernberg & Rotondo, 2010). As a result, rural trauma centers are often challenged to implement quality benchmarking and adequately evaluate

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| Column Title | All columns have a pull down table with choices |
|---|---|
| Prehospital managed airway for patient with GCS<9 | This is a Yes/No/NA selection. Answer yes if the airway was managed appropriately, no if it was not. N/A if the GCS was ≥ 9 . Managed airway is defined as an intervention more than oxygen, i.e. Bag mask, OPA, intubation, etc. |
| Adhered to trauma team activation criteria | Answer Yes if this was activated appropriately or answer No if it was an underactivation. N/A if the patient did not meet activation criteria and was not activated. |
| The physician trauma team leader responded within 20 minutes of notification | Select Yes if the provider arrived on time for the trauma team activation or No if they did not. N/A if this was not an activation. |
| Patient with GCS<9 in ED: intubated in <20 minutes | Select Yes if the patient was intubated < 20 minutes or No if > 20 minutes. N/A if the patient had a GCS ≥ 9 . |
| ED LOS<4 hours for patient arrival to transfer | Select Yes or No as appropriate. N/A if the patient was admitted. |
| Adhered to admission criteria outlined in facility's scope of care | Select Yes or No as appropriate. N/A if the patient was not admitted. |
| Appropriate documentation of GCS on arrival, discharge, and with change of status | Select the appropriate choice or combination of choices |

Figure 2. Instructions the 2016 performance improvement data collection template.

team presented the data to each facility in the form of a report that was unique to each center. The reports included compliance average of each filter and a facility report card made up of overall compliance averages for each filter. These compliance averages helped create a composite rank score among each center; the rank score displayed overall average filter compliance of each facility to rank one against another.

This was a retrospective observational project, which occurred over 1 year from January 1, 2016, through December 31, 2016, at eight Level IV and one Level III trauma centers. We included 924 trauma patients admitted to, or transferred out of the trauma centers, and excluded patients only seen in the ED and discharged home. The local institutional review board designated this PI project as nonhuman subject research. We analyzed each filter's average compliance time trends using Cochran-Armitage trend tests and we used SAS 9.3 (SAS Institute Inc, Cary, North Carolina) for all analyses. Two-tailed tests with α values of .05 were used on all tests.

RESULTS

The following seven PI filters were identified, retrospectively collected, and analyzed by quarter in 2016: prehospital managed airway for patients with a Glasgow Coma Scale (GCS) score of less than 9; adherence to trauma team activation criteria; evidence of physician team leader response within 20 min of activation; patient with a GCS score of less than 9 in the ED: intubated in less than 20 min; ED length of stay (LOS) less than 4 hr from patient arrival to transfer; adherence to admission criteria outlined in facility's scope of care; and documentation of GCS on arrival, discharge, or with change of status.

A total of 924 patients were captured in the 2016 template; 55% were transferred out of the facility, 43% were admitted, and 1% died. Seventy-seven percent of patients were transferred out of the initial facility in less than 4 hr. There was a significantly decreasing compliance trend over time for ED LOS of less than 4 hr (Table 1, Figure 3, p trend = .04). Seventy-five percent of patients had appropriately documented GCS scores, with a significantly

TABLE 1 Compliance Averages by PI Filter

| Filter | Average ^a | p Trend ^b |
|--|----------------------|------------------------|
| Prehospital-managed airway for patients with GCS <9 | 67% | .88 |
| Adhered to trauma team activation criteria | 90% | .08 |
| Physician leader responded within 20 min of notification | 98% | .27 |
| Intubation in ED: <20 min for patients with GCS <9 | 57% | .18 |
| ED LOS <4 hr from patient arrival to transfer | 77% | .042 |
| Admission criteria adherence | 97% | .39 |
| Appropriate documentation of GCS | 75% | <.001 |

Note. ED = emergency department; GCS = Glasgow Coma Scale; LOS = length of stay; PI = performance improvement.

^aIndicates average filter compliance across all facilities.

^bExamined the presence of compliance trends across four quarters in 2016 using Cochran-Armitage trend tests.

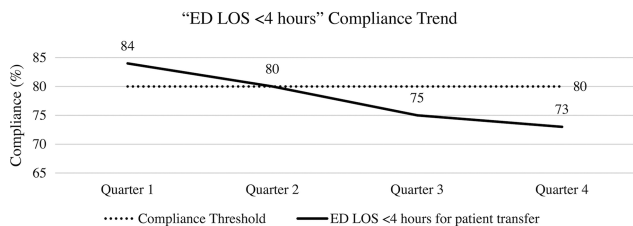


Figure 3. There was a significantly decreasing compliance over time to the “ED LOS <4 hours” filter. By applying a theoretical compliance threshold, we can see how the facilities responded to the program.

increasing trend toward appropriate documentation of GCS over time (p trend < .001, Figure 4). Thirty-seven percent of patients had trauma team activations, and adherence to activation criteria was trending toward significance (p trend = .08). All other filters did not show any significant trends over time. The average composite rank score of the filters across all facilities was 81.4% (Figure 5).

Ongoing discussions with the TNCs throughout the year highlighted some confusion and miscommunications on the instructions for the filters “prehospital managed airway for GCS <9” and “documentation of GCS on arrival discharge or with change of status.” In addition, it was found that “ED LOS < 4 hours” and “adherence to admission criteria” both benefited from more specific information; thus, the four filters were amended for the 2017 template (Figure 6) on the basis of ongoing feedback from the facilities.

DISCUSSION

The ACSCOT manual states that a trauma center’s PI program should monitor and continually improve structures, processes, and outcomes, which can be accomplished through a standardized benchmarking tool (ACSCOT, 2014). However, it remains challenging in rural Colorado to develop and manage a PI program consistently, especially where the TNCs are often tasked with multiple roles, have a high turnover rate, and face geographical challenges for timely patient transfers (Whitney et al., 2010). In this ongoing PI project, we have established an

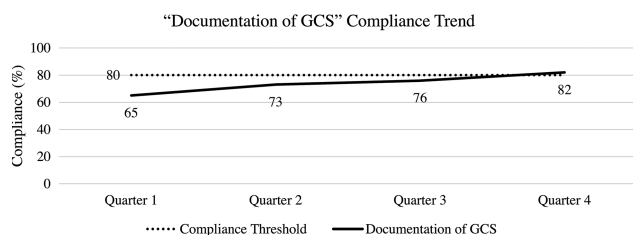


Figure 4. There was a significantly increasing compliance over time for “documentation of GCS.” By applying a theoretical compliance threshold, we can see how the facilities responded to the program.

initial set of seven PI filters on the basis of key elements of rural trauma centers, and on ACSCOT recommendations. Our data suggest that educational efforts should focus on more efficient and timely intubation among patients with severe traumatic brain injuries (TBIs) in the ED. We also must better understand if “ED LOS <4 hours” is an appropriate metric for less critical patients. In addition, we found that these trauma centers are routinely tracking trauma care processes, and a large majority of facilities are adhering very well to their trauma team activation criteria and scope of care. Through implementation of a basic PI benchmarking tool, we have helped our rural affiliates consistently track and collect meaningful data, better understand their outcomes, and move toward improving their processes of care.

Trauma outreach can lead to an increase in peer reviews and performance improvement initiatives (ACSCOT, 2014; Biffl et al., 2002; Byrnes et al., 2010; Hendryx et al., 1998; Vernberg & Rotondo, 2010), which we have found since the inception of our Rural Trauma Outreach Program (Soychak et al., 2013). Continual peer review and feedback to our rural affiliates were essential for the validity of the PI project; quarterly conference calls were needed to assist with benchmark interpretation and data validation. Regular communication on the PI program among the facilities led to a better understanding of quality benchmark utilization and resulted in positive changes, including clarity in interpretation of filter definitions and improved data collection. For example, because one facility is a Level III trauma center, we clarified that the filter measuring trauma leader response within 20 min was specific to the highest level of activation at Level III centers. After this clarification, the trauma leader response times for this facility improved.

In addition, there were miscommunications throughout the year surrounding two PI filters: prehospital-managed airway for patients with a GCS score of less than 9 and documentation of GCS. Through presentation of our data reports at the end of the year to each facility, TNCs had a better grasp of their data and we took corrective action to ensure all TNCs understood the purpose of these two filters. First, we refined the instructions for the prehospital airway management filter by further defining managed airway to show that it was an intervention appropriate to the level of the emergency medical service (EMS) provider and the situation in the field. Discussions on this filter indicated that facilities were not taking the level of the EMS provider into consideration and were counting king airways or bag mask ventilation as inappropriate management. We believe the disconnect between the intention of this filter, and how facilities interpreted it, was artificially depressing the compliance rate. Second, documentation of GCS varied among facilities; we discovered several facilities were not documenting GCS at discharge if there were no changes in the patient’s GCS, because it was

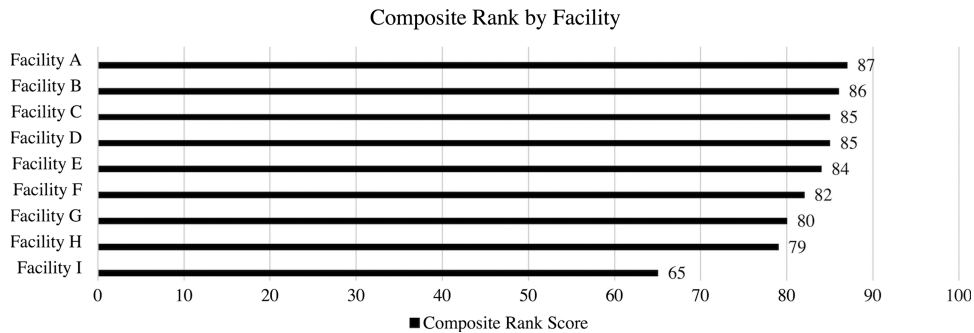


Figure 5. The average composite rank score among facilities for 2016 was 81.4%. By ranking each facility against one another, we helped foster competition and improve program participation.

not required in their own guidelines. We redefined the requirements for this filter in our 2017 template, which now reads “Compliance with Facility GCS Documentation Guidelines,” so each facility is graded according to its own documentation requirements.

Furthermore, “ED LOS <4 hours” showed a significantly decreasing compliance trend in 2016, which prompted discussions with each facility at the end of the year about the types of patients who were being included in the filter. Through our discussions, we discovered the facilities were flagging both urgent and nonurgent patients, in

addition to emergent patients, which contributed to delayed transfers, and lower compliance. A majority of the facilities also claimed they had no specific documentation criteria for these different patient transfer categories and needed help defining them. This discord led to sharing of best practices between facilities. One of the facilities shared information on their definitions and documentations of transfer patient categories: “emergent patient,” “urgent patient,” and “nonurgent patient,” and as a result, we applied these categories to our 2017 template. These categories will help us measure the average transfer times

| Column Title | All columns have a pull down table with choices |
|--|--|
| Prehospital managed airway for patients with a GCS <9 | This is a Yes or No or N/A selection. Select N/A if the patient arrived with a GCS ≥ 9 For patients with a GCS <9: Managed airway is defined as intervention appropriate to the level of EMS provider and the situation in the field i.e. OPA, oxygen & bag mask for EMT, paramedic intubation, king airway, OPA, oxygen & bag mask when intubation is unsuccessful or not indicated. A no response would be used when after the TNC/TMD evaluation of the case it was decided that the airway was inappropriately managed in the field. |
| Emergent Patient: ED LOS <4 hours prior to transfer | This section is intended to identify patients who require expedited transfer. These are defined as: Emergent patients are considered to have a “life or death” accident or illness that require immediate attention without delays in definitive care i.e. TBI requiring intubation, TBI epidural hematoma or expanding subdural intracranial hemorrhage, limb threatening ortho or vascular injury, persistent hemodynamic or respiratory instability, or as determined by the trauma medical director or trauma coordinator/manager. Select Yes or No as appropriate. N/A if the patient was admitted. |
| Urgent Patient: ED LOS <4 hours prior to transfer | This section is intended to identify patients who require urgent transfer. These are defined as: Urgent patients require immediate attention, but may be delayed if necessary i.e. single system orthopedic injury requiring operative intervention or as determined by the trauma medical director or trauma coordinator/manager. Select Yes or No as appropriate. N/A if the patient was admitted. |
| Non-Urgent: Patient ED LOS <4 hours prior to transfer | This section is intended to identify patients who require non-urgent transfer. These are defined as: Non-urgent patients are those whose care may be delayed as determined by the trauma medical director or trauma coordinator/manager. Select Yes or No as appropriate. N/A if the patient was admitted. |
| Adhered to admission criteria outlined in facility specific scope of care | Select Yes or No as appropriate. N/A if the patient was not admitted. |
| Admission Diagnosis of the patient admitted outside your scope of care | Select from list of potential diagnosis for <i>ONLY</i> patients that were deemed outside your facility's scope of care. |
| Compliance with Facility GCS Documentation guideline | Select Yes or No as appropriate to your specific facility guidelines. |

Figure 6. Revised 2017 data collection template instructions. Changes were made to “ED LOS <4 hours,” “adherence to admission criteria,” and “documentation of GCS.”

for each category, and come to a consensus on the appropriate transfer times per category. Finally, we added a diagnosis pull-down for the filter examining adherence to admission criteria for our 2017 template, to better understand the types of patients being admitted outside the facility's scope of care.

Although outreach and peer review for lower level trauma centers can provide education on, and assistance with, quality benchmarking to improve trauma care processes, research on this topic is scarce (Byrnes et al., 2010; Lang, Simon, & Kilgore, 2016; Vernberg & Rotondo, 2010). The ACSCOT manual provides benchmarking categories more suitable to higher level facilities, but not specific definitions for rural trauma centers (ACSCOT, 2014). Our PI program is unique from others because we developed a PI benchmarking program tailored to Level III and Level IV trauma centers. Level IV trauma centers are not recognized for designation in all states, and for many years, an American College of Surgeons (ACS) verification process for Level IV trauma centers was not available (Vernberg & Rotondo, 2010; Whitney et al., 2010). Byrnes et al. (2010) discussed how they developed their own quality improvement outreach program and set of filters to measure outcomes. However, unlike our program, each of the rural centers in their project did not hold any trauma center designation through the ACS or the state during the project, and only included patients who were transferred to their higher level trauma center, making it difficult to provide a method to support the entire PI program and to compare centers.

Lang et al. (2016) described the process of implementing a benchmarking program for Level III trauma centers with the use of several metrics to measure patient outcomes. Similar to our program, the Lang et al. study measured trauma team activations, leader response times, and ED LOS, but did not contain PI filters on airway management for patients with severe TBIs (Lang et al., 2016). Another publication by Vernberg and Rotondo (2010) described how to create sustainable rural trauma systems by including PI filters, but the filters were limited to Level III centers. Vernberg and Rotondo proposed three filters that measured metrics similar to those in our program, such as ED LOS does not exceed 6 hr, establishment of a definitive airway for patients with a GCS score of 8 or less, and trauma team leader response within 30 min, but filter compliance data were not discussed. Our transfer time metrics were also more aggressive than those previously mentioned; we believe the current Colorado requirement of 6 hr for transfer is too long for seriously injured patients, except in cases impacted by severely adverse weather. Although our facilities reported low compliances with this benchmark, we believe that delineating emergent, urgent, and nonurgent categories, as well as upholding a higher standard, will eventually improve the processes of care.

CONCLUSIONS

Our program showed that using a standardized data collection tool was essential for collecting individual facility and aggregate quality benchmark results. Without funding or consistent education and direction on how to drive a PI program, many rural centers struggle to identify areas for improvement. Through networking and continual outreach support to rural facilities, we helped TNCs understand their facility's outcomes, which eventually led to sharing of PI benchmarking data with their trauma committees. By creating network benchmark reports that were unique for each facility, we encouraged healthy competition among facilities and fostered additional enthusiasm for continued active participation in the program. Furthermore, the network reports were utilized at each facility's Performance Improvement and Patient Safety meeting to identify opportunities for improvement.

This project may serve as a platform for other rural centers to partner with their regional centers and pursue their own PI program. Outreach programs can provide continual education and assistance with identifying systematic issues that may be helpful in states with a trauma system. Moving forward, these data will be used to develop specific compliance thresholds, to identify areas for improvement and create corrective action plans as necessary.

There were several limitations to this project. First, because there were different perceptions and interpretations of several of the PI filters, examining the validity of the filter data may be limited. However, we sought to validate the data and further clarify the PI filters with each of our centers every quarter. Second, we did not have a randomized control group, and thus were unable to establish definitive causality between our intervention and any changes seen in PI filters over time. Finally, because of the continual changes in filter definitions, we were unable to develop an appropriate compliance threshold in 2016. This remains a future goal as we move forward and revise our program.

KEY POINTS

- Level III and IV trauma centers are known for their geographic isolation from other high-level facilities. They are responsible for advanced trauma life support before patient transfer and often have a very broad trauma team, with TNCs covering multiple roles.
- TNCs have minimal time and experience to implement a PI program to properly evaluate their outcomes. This can be remedied with a consistent working relationship with higher level facilities in its system, which can provide peer review and education on benchmarking tools and data.
- A relatively simple PI benchmarking tool can lift some of the burden from rural facilities, enhance the understanding of data, and improve the processes of patient care.

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