



Using a multidisciplinary and evidence-based approach to decrease undertriage and overtriage of pediatric trauma patients



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ABSTRACT

Background: The American College of Surgeons Committee on Trauma (ACS-COT) view over- and undertriage rates based on trauma team activation (TTA) criteria as surrogate markers for quality trauma patient care. Undertriage occurs when classifying patients as not needing a TTA when they do. Over-triage occurs when a TTA is unnecessarily activated. ACS-COT recommends undertriage <5% and overtriage 25–35%.

We sought to improve the under-triage and over-triage rates at our Level II Pediatric Trauma Center by updating our outdated trauma team activation criteria in an evidence-based fashion to better identify severely injured children and improving adherence to following established trauma team activation criteria.

Methods: This study was designed prospectively as a Process Improvement Patient Safety (PIPS) project in two phases. Data was obtained from our trauma registry. Prior to the initiation of Phase I, the TTA was modified using the best available evidence at the time. A Base Station report was modified to include elements of the TTA to be checked when EMS called prior to arrival to guide in activation. Phase I of the study (April 1–June 30, 2011) involved improving adherence to activating a trauma according to our newly revised TTA criteria. Phase II of the study (July 1, 2011–June 30, 2012) moved the trauma team activation responsibility primarily to nursing (collaborating with MDs) and including activation criteria regarding transfers-in from outside hospitals. Triage rates were calculated using the Cribari method: undertriage = patients with an ISS >15 for which a major or modified was not activated, and overtriage = patients with an ISS <16 for which a major was activated.

Results: 2011 Q1 YTD data was used as a baseline comparison. Baseline undertriage was 15% and overtriage was 75%. Phase I demonstrated 90% use of the redesigned Base Station report reflecting the new TTA criteria and was validated by RN/MD signatures. This resulted in an undertriage rate of 10% (12/118) and an overtriage rate of 20% (1/5). During Phase II, there was 100% use of the newly redesigned Base Station report. Phase IIa (concluding the data collection for 2011) demonstrated an undertriage rate of 8.4% (19/226) and an overtriage rate of 38% (5/13). Data during Phase IIb indicated an undertriage rate of 4.7% (12/251 pts) and overtriage rate of 54% (7/13). During baseline phase of the study, 50% of major patients went to the OR from the ER. During Phase I all major activations required admission to the PICU (4) or the OR (1). Finally, during Q2 2012 (the last quarter of Phase II), 25% of majors went to OR (2/8), 50% to ICU (4/8), 12.5% to Med-Surg (1/8), and 12.5% to home (1/8).

Conclusions: Standardization of process resulted in improved, sustainable under-/overtriage rates. Undertriage rates dropped from 15% to 5% undertriage, the ACS-recommended standard. Appropriate triage appears to have correlated with appropriate utilization of resources.

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The American College of Surgeons and the Washington State Department of Health (DOH) view overtriage and undertriage rates based on trauma team activation (TTA) criteria as surrogate markers for quality trauma patient care. The TTA criteria was adapted from the field triage decision scheme recommended by the CDC [1]. It is an internal hospital

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triage tool that determines if an injured patient requires trauma team activation, followed by the tier of activation (major versus modified utilizing our institution's nomenclature). The optimal triage of trauma patients is thought to translate into decreased transport times by prehospital personnel to definitive care, better outcomes for injured patients, and improved resource utilization by having the appropriate level of resources available for standardized evaluation of these patients. Both are now required to be tracked and reported to the monthly trauma multi-disciplinary meeting by the current Resources for the Optimal Care of the Injured Patient [2].

Leveling triage accuracy and consistency has a positive impact on patient safety and delivery of quality trauma care. The American College of Surgeons-Committee on Trauma (ACS-COT) recommended that trauma

programs establish a goal to maintain undertriage below 5–10%, and they defined an acceptable overtriage rate of up to 30–50% at the time of the study. Currently, the ACS-COT recommends undertriage <5% and overtriage 25–35% [2]. Undertriage is defined as a triage decision that classifies patients as not needing a TTA, when in fact they do. Undertriage is a medical problem, which may result in adverse patient outcomes. When a trauma case is overtriaged, a TTA is activated when criteria was not met, over utilizing resources.

To that end the Eastern Association for the Surgery of Trauma (EAST) has published recommendations based on Level 3 recommendations. Pediatric triage should include:

- A two-tiered triage system in the ED by physicians can effectively reduce unnecessary resource utilization.
- Mechanism of injury alone may not be useful in triaging pediatric patients.
- A combination of physiologic and anatomic parameters with mechanism provides better triage utilizing age-appropriate vital signs.

These recommendations were based on a systematic review of moderate quality data [3].

The authors sought to improve the undertriage and overtriage rates at our community Level II Pediatric Trauma Center by 1) improving accuracy in following established trauma team activation criteria and 2) modifying established trauma team activation criteria in an evidence-based fashion to better identify severely injured children. We implemented a process improvement patient safety (PIPS) project utilizing a Lean 4-step problem solving approach methodology to better understand our current triage rates. We then asked the question if undertriage would improve further if we adjusted the countermeasure by moving leveling responsibility to Emergency Department (ED) nurses for all pediatric trauma (using current TTA criteria and a revised Base Station form) (Figs. 2 and 3, respectively). Increasing awareness of the importance of appropriate resource utilization prompted the development of a systematized procedure for impacting under- and overtriage rates within our large, community health care system.

1. Methods

1.1. Lean process

Pediatric trauma services led a PIPS project at Mary Bridge Children's Hospital (MBCH), a Level II Pediatric Trauma Center in Tacoma, Washington from 2011 through June 30, 2012, with data analysis completed in September 2012. The baseline phase of the study was Q1 YTD 2011. A Lean 4-Step Problem Solving Approach (Plan-Do-Check-Adjust) was developed by the Trauma Program Manager (TPM - CJM) and approved by the Trauma Medical Director (TMD - MAE) [4]. Trauma services worked in collaboration with MBCH Emergency Department/Base Station leadership to provide education and training to staff (MDs & RNs) that determine the level of trauma team activation. The Trauma Registrar tracked data through the trauma registry and made clerical revisions to the TTA criteria and Base Station documents as necessary. The TPM routinely reported PIPS progress at MBCH pediatric trauma quality assurance (QA) and Multidisciplinary Committee Meetings.

1.2. Trauma team activation redesign

The TTA was critically reviewed and revised during the baseline phase of the study. The authors assumed leadership of the Trauma Department in 2010. It was noted at that time that the TTA had not been reviewed, revised, or renewed since 2007 (Fig. 1). Three tiers of activation existed at that time, and several new pediatric criteria were not considered in the original TTA. Furthermore, mechanism of injury was the branching point in the decision making tree for TTA. The TTA criteria was updated based on guidelines published by the American College of

Surgeons, Committee of Trauma (ACS-COT), WA State DOH Governor's Steering Committee on EMS and Trauma (WA DOH-EMS/Trauma) and CDC with a focus on head injuries, the primary finding in undertriage patients pre-study [1,2]. Other drivers for the selected changes included a thorough review of the then current literature and Washington State Administrative Code (WAC) [5–8]. The Society of Trauma Nurses List-Serve was also used to obtain and review outside pediatric trauma hospital policy/procedures for determining appropriate levels of activation. The initial changes implemented in the TTA are listed in Table 1.

The Trauma QA Committee and the WA DOH-EMS/Trauma approved the MBCH trauma team activation criteria for use in triaging EMS transport from the scene, arrivals to the ED by privately owned vehicles (POV), and trauma transfers. The TTA criteria outlined in boxes A-B-C (and eventually box D) determined the appropriate level of activation (major or modified for our two-tiered system). The elements of the newly designed TTA were then imbedded in the Base Station report, so that when EMS called in a report, the elements could quickly be checked to help determine a) the need for activation and b) what level of activation was required. Under- and overtriage rates were then calculated by using the Cribari grid (Fig. 4) [2].

1.3. PIPS design

Data was obtained from our trauma registry as follows: (1) 2011 Q1 YTD data was used as a Baseline (pre-study); (2) Phase I (April 1 through June 30, 2011) of the study involved using the newly updated TTA. The MBCH Base Station form was revised to reflect key components of TTA criteria (Fig. 3). All pediatric trauma activations were evaluated using the Cribari grid for triage accuracy (Fig. 4) [2]. Essentially, undertriage was defined as patients with an ISS > 15 for which a major or modified was not activated, and overtriage was defined as patients with an ISS < 16 for which a major was activated.

Structured education and training for MDs and RN/charge nurses occurred during this phase, and signatures were required of the MD and RN filling out the Base Station report. (3) Phase II (July 1, 2011 through June 30, 2012) of the study moved the trauma team activation responsibility primarily to nursing (with a component of collaboration with MBED MDs). Data was analyzed during Q3 2012 and continuing trends were documented. A second wave of structured education occurred with all RN staff. Box (D) was added to the TTA criteria to address transfers-in from outside hospitals (Fig. 2).

2. Results

The MBCH undertriage rate during Q1 2011 YTD at baseline was 15%. The Cribari grid for the baseline data is presented as Table 2. 72 trauma cases (4 major [6%], 18 modified [25%]) were evaluated at baseline, and 10/68 cases were undertriaged. Our overtriage rate was 75%, which indicated criteria were not being applied consistently or accurately in 3/4 cases. We defined accuracy of the use of the TTA as 85% based on the undertriage rate.

Phase I was April 1 through June 30, 2011 (Q2 2011). The main goal during this phase was to assess accuracy of the use of the TTA tool and track under-/overtriage rates. During this phase, there was 90% use of the newly redesigned Base Station report. There were 123 total traumas during Q2 2011 (5 major [$<1\%$], 36 modified [29%]), and the Cribari grid for Q2 2011 data is presented as Table 3. Undertriage rates improved to 10% (12/118), and overtriage dropped to 20% (1/5) during Phase I.

Phase II was July 1, 2011 through June 30, 2012, with an analysis completed and data check through September 30, 2012. Phase II was evaluated for Q3 and Q4 2011 (IIa) and Q1 and Q2 2012 (IIb) (Tables 4a and 4b). There were 503 total traumas during Phase II, 26 (5%) of which were Major, and 180 (36%) of which were modified traumas. Phase II continued to demonstrate improving under- and overtriage rates. Phase IIa (concluding the data collection for 2011)

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