

STATEWIDE DISCHARGE DATA SUPPORTS DEVELOPMENT OF INCLUSIVE TRAUMA SYSTEM

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Introduction: American College of Surgeons verification and state designation of trauma centers (TC) are tools utilized to optimize outcomes in the care of injured patients. Where participation in organized care is optional, new legislation to mandate participation in an inclusive trauma system (TS) may require demonstration of an outcomes gap. Given differences in populations treated TC versus non TC (NTC), a validated risk adjusted methodology is required for comparison. ICD 10 based injury severity score (ICISS) has been validated and utilized for comparison of outcomes.

Methods: After IRB approval state Healthcare Cost and Utilization Project (HCUP) data 2018-2020 was utilized and TC and NTC compared. All patients, pediatric, non geriatric adult, geriatric patients, subgroups of femur fracture, and traumatic brain injury (TBI) groups were evaluated for mortality and complications.

Results: Of 3,316,016 discharges, 593,157 (17%) had at least one injury diagnosis code. After excluding transfer patients, 375,541 records remained. 56.5% of patients were treated at TC and had lower risk adjusted mortality, a lower frequency of acute kidney injury (AKI), ventilator associated mortality, pulmonary embolus and surgical site infection as well as lower mortality with AKI. In subgroup analysis comparisons were hampered by the disproportionate treatment of some subgroups at TC, including all pediatric subgroups, 82.8% of TBI and 97.6% of shock subgroups. Where statistical significance was achieved, increasing age, increasing severity of injury, female gender and treatment at a NTC adversely affected survival in multivariate analysis. More patients with proximal femur fractures were treated at NTC (55%) and there was no benefit from TC treatment on risk adjusted mortality. Race only influenced mortality outcomes in TBI 0-15.9 and AKI.

Conclusions: Comparison of outcomes in hospitals in a state with a non inclusive TS demonstrates improved outcomes in injury care at TC, as well as demonstration that current destination protocols bring the majority of patients with some significant injuries preferentially to TC. These data provide support for TS development, including consideration for a more inclusive TS where uniform clinical data acquisition can be used for risk adjustment. Limitations include the need to eliminate transferred patients to avoid duplication and the use of discharge codes for patient classification.

THE HIDDEN POST-INJURY BURDEN: FRAGMENTATION OF CARE AFTER BLUNT PANCREATIC INJURY

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Introduction: Readmission to a different hospital leads to fragmentation of care (FC), and trauma patients may be uniquely vulnerable to FC. We analyzed FC incidence and outcomes after blunt pancreatic injuries (BPI).

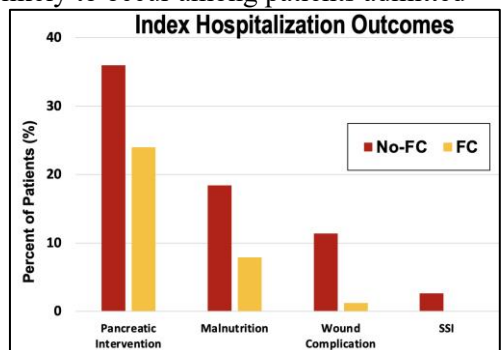
Methods: The California Office of Statewide Health Planning Development dataset was evaluated for BPI (2016-2020). The primary outcome was FC rates by 6 months of discharge. FC were compared with those readmitted to their index admitting facility (no-FC). Distressed Communities Index (DCI) was used to measure socioeconomic factors.

Results: Among 539 patients with BPI, 264 met inclusion criteria. Over half of BPI (61%) experienced FC. Mechanism of Injury, Injury Severity Score, and abdominal Abbreviated Injury Score were similar between groups. Patients with FC had shorter index lengths of stay (4 v. 13 days) and shorter time to readmission (1 v. 15 days, both $p < 0.01$). FC was less likely among patients who underwent operative interventions (36% v. 24%, $p = 0.02$). There was no difference in age, sex, race, or intervention rates between groups at readmission. FC was more likely to occur among patients admitted to centers in low DCI areas.

Patients with surgical site infections, malnutrition, or wound complications during index hospitalization were less likely to have FC (Fig). Among those with FC, 4% required intervention, and 1% died. Inflation-adjusted, median cost did not differ at the index hospitalization, nor the readmission between groups.

Mortality during readmission did not vary by FC status.

Conclusion: BPI patients demonstrate a significant incidence of fragmentation of care. FC was more likely for centers in less distressed communities, and less likely for patients that had interventions, or incurred major wound or infectious complications.



COMMUNICATION MATTERS: THE IMPACT OF TRAUMA INFORMED CARE ON PATIENTS, FAMILIES, AND PROVIDERS

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Introduction: Trauma-informed care (TIC) is a set of principles designed to improve trauma care by recognizing the pervasive nature of trauma experiences; surgeon engagement can have significant impact on the trauma family experience. We aimed to characterize: 1) families' experience of communication in the Trauma Acute Care Surgery (TACS) ward, 2) differences between communication in TACS and the Surgical Trauma Intensive Care Unit (STICU), and 3) families' mental and emotional state.

Methods: This study was conducted at a Level I Trauma Center with a General Surgery Training Program. Surveys were collected from adult family members of patients admitted to TACS and STICU, as well as their attending and resident surgeons. Information access and communication with surgeons in TACS and STICU were compared using Wilcoxon rank sum test.

Results: TACS family members (N=42) and surgeons (N=27) completed surveys on 40 unique patients; data previously collected in the STICU included 88 families. TACS families reported meeting with a doctor less frequently (mean 3.44 times) than in STICU (mean 4.56; $P=0.045$). TACS families reported reduced information access, such as being able to get questions answered (50% TACS vs. 96% STICU; $P<0.001$) and being included in rounds (38% vs. 73%; $P<0.001$). Compared to STICU, TACS families agreed less frequently that the surgeon explained things in a way they could understand (71% vs. 90%; $P=0.023$) and listened carefully to them (69% vs. 85%; $P=0.001$). In TACS, families were less able to count on their friends for support (69% vs. 98%; $P<0.001$) and more likely to have little interest or pleasure in doing things (64% vs. 48%; $P=0.024$).

Conclusion: Family members report poorer quality of engagement with their providers, reduced access to information, and lower opinion of the quality of care after the ICU setting, while also experiencing less community support and increased anhedonia, a major symptom of depression. We recommend an increased focus on TIC principles in training and continuing education for both nurses and physicians to encourage care that increases patient and family control, validation, and empowerment for improved outcomes.

UNDERSTANDING THE NEEDS OF MEN EXPERIENCING DOMESTIC VIOLENCE WITHIN HOSPITAL-BASED VIOLENCE INTERVENTION PROGRAMS

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Introduction: An approach to reduce re-injury among trauma patients is linkage to hospital-based violence intervention programs (HVIPs) at time of injury. While domestic violence (DV) is a common cause of interpersonal violence, it is unclear what proportion of HVIP resources should be tailored to this violence type. We sought to characterize the extent of HVIP engagement dedicated to DV at a Level I Trauma Center, over five years.

Methods: This study uses mixed methods to examine the needs of patients engaged by our hospital's HVIP due to DV. Bivariate analysis of HVIP data contextualized the prevalence of imminent risk factors among patients with chi-square testing. Qualitative methods uncovered perceptions of patients among HVIP frontline staff using constructivist grounded theory. We analyzed patient cases to understand how staff build rapport with DV patients and assess their needs regarding imminent risk and safe discharge.

Results: Since 2018, our HVIP engaged more than 7,305 patients, with 12.5% presenting for injuries due to DV. Men and women have a similar likelihood of reporting DV, 57.2% and 42.8% ($p < 0.001$). Men engaged for DV report more imminent risk factors, relative to men engaged for community violence (CV) ($p < 0.001$). Factors include that someone currently wishes to harm the patient, patient was intended target, and patient experienced a similar injury in the past. Gendered stigma around DV deters men from seeking supports, including concerns with credibility and lack of confidence in ability to access services. Qualitative findings suggest HVIP staff occasionally misclassify an incident as CV, especially when a man is involved, and that there are challenges securing DV referrals for men.

Conclusion: At a new Level I trauma center, a significant share of men engaged by our HVIP report DV. DV in men is frequently conflated with CV. HVIP staff build a unique relationship and rapport with patients that may foster a safe environment for DV disclosure, especially among men. There is an opportunity for HVIPs to develop improved protocols to support men experiencing DV.

UNRAVELING THE VALUE OF TRAUMA ACTIVATION PAGES USING NATURAL LANGUAGE PROCESSING AND CLINICAL INTUITION

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Introduction: Hospitals generally circulate trauma activation pages to alert providers of incoming trauma patients. The content of such pages is often limited, sometimes misleading and inaccurate, and there is minimal to no standardization of content. The optimal content and structure for conveying patient acuity and clinical requirements is unknown. In this study, we sought to investigate the correlation between content of trauma activation pages and injury severity, as measured by Injury Severity Score (ISS). Surgeons and natural language processing algorithms were asked to predict injury severity and determine if a page containing limited data could convey equivalent information to a full, unstructured page.

Methods: All trauma activations from 2017 to 2021 at a single, academic level 1 trauma center were identified; patient demographics, trauma activation pages, activation level, mode of arrival, and injury severity scores were obtained. Descriptive statistics were performed. First, we asked attending trauma surgeons and acute care surgical fellows (N=6) to predict patient ISS clusters and likelihood of requiring surgical or interventional procedure within 6 hours of presentation based on (a) limited data elements and (b) the full text of the page. Natural language processing methods were applied to assess the value pages. In particular, term frequency-inverse document frequency (text frequency) analysis was performed. Logistic regression was used to independently predict injury severity based on (a) limited data elements (patient demographics, activation level, and transfer status) and (b) the full text of activation pages. Feature importance of individual phrases was assessed within each group. Model performance was assessed using accuracy and area under the receiver operating characteristic curve.

Results: Data for 3,797 trauma activations were obtained. Mean patient age was 48 years (SD +/- 21). 21% (N=794) were classified as high priority ("STAT"). Nearly 53% of patients presented directly from the scene (N=2023), with the remainder being transferred after initial evaluation at another hospital. Median ISS was 5 (IQR 4-10). On average, activation pages contained 9.4 words. The following 5 words were most frequently included in the page: fall (N=1595), crash (N=1454), motor vehicle (N=1238), fracture (N=689), and struck (N=511). Surgeons correctly predicted the ISS clusters for 49.4% (355/718) and 42.9% (256/597) of pages based on full text and limited data only, respectively. Text frequency analysis had an accuracy of 67% (95% CI: 64-70%) to predict injury severity clusters. Accuracy dropped to 32.0% when using limited data elements in a logistic regression model (Panel A). Independent of model type, activation level was most highly correlated with severity (odds ratio = 1.89, $p < 0.05$). Feature importance is stratified by injury severity (Panel B). Surgeons correctly predicted whether a patient would require an intervention within 6 hours of presentation in 80.9% and 83.9% of cases, though the positive predictive value was 25.9% and 24.6% based on predictions for full text and limited data.

Conclusion: The full content of trauma activation pages was more predictive of injury severity than a page that only included a limited subset of objective data. Surgeons showed similar capabilities; they were able to predict ISS clusters with higher performance when given more data. However, in all cases, trauma page information was only moderately predictive of ultimate injury severity. Future research is needed to further investigate the optimal content of trauma activation pages.

THE ABC SCORE DOES NOT PREDICT TRAUMATIC HEMORRHAGE IN AN INDIAN TRAUMA REGISTRY

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Introduction: In low- and middle-income countries (LMICs), the burden of trauma is high while access to blood products is limited. Effective decision-support tools are needed to help decide whether to mobilize scarce resources, such as massive blood transfusion. Our primary aim was to assess the performance of the Assessment of Blood Consumption (ABC) score - a common decision-aid for initiating massive blood transfusions in high-income country (HIC) trauma systems - within the Indian context.

Methods: We analyzed data from the Towards Improved Trauma Care Outcomes (TITCO) database, a prospective cohort of injured patients who presented to four Indian public hospitals between 2013 to 2015. We classified patients as having traumatic hemorrhage if they had an ICD-10 code for a solid organ injury and/or hemorrhage and also received at least one unit of transfusion. Test characteristics of the ABC score were assessed with area-under-the-receiver-operator characteristics (AUC) curves. Patient demographics, injury characteristics, and clinical outcomes were analyzed using multivariate logistic regression models to identify factors associated with traumatic hemorrhage.

Results: Of 5,080 patients were included in this analysis, 353 (6.95%) were identified as having traumatic hemorrhage and 4,727 (93.05%) were not. In this population, the ABC score had a sensitivity and specificity of 32.4% and 90.7%, respectively, when a cutoff of greater than or equal to 2 was used to predict bleeding. Logistic models revealed that road-traffic injury (RTI), arrival by private vehicle, elevated HR, low SBP, positive FAST, and mild GCS were all positively associated with traumatic hemorrhage.

Conclusion: The performance of the ABC is poor in the Indian context. Clinicians should use caution in applying decision-support tools developed for other contexts to their own. Several injury and patient characteristics were identified that may have more relevance to decision for transfusion in the urban Indian trauma setting.

THE STATUS OF ROAD SAFETY IN QATAR AFTER A DECADE OF ACTION: ANALYZING NATIONAL STATISTICS AND NATIONAL TRAUMA REGISTRY DATA

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Introduction: Road traffic injuries [RTIs] are the leading cause of preventable mortality in Qatar. In 2011, the country opted to participate in the Decade of Action for Global Road Safety [DoARS], with the goal to reduce the number of road traffic deaths and injuries by 50% by 2020. The objective of this study is to analyze indicators of road safety in Qatar, from 2011-2020, by combining national statistics and trauma registry data to report the status of road safety in Qatar and make recommendations to further improve road safety

Methods: Data on all patients with moderate to severe road traffic injuries seeking hospitalization and/or care from 2011-2020, were collected from the trauma registry of the national Level 1 trauma referral center. Monthly and annual aggregate data on road traffic deaths, injuries and motor vehicle crashes, from the publicly accessible website of the Ministry of Development, Planning and Statistics were likewise collected.

Results: The RTI death rate [per 100,000 population] was reduced by 61% and the RTI rate reduced by 38%, from 2011 to 2020. The pre-hospital RTI death rate dropped by 60% while the in-hospital RTI death rate was reduced by 65%. It is estimated that 858 potential road deaths were prevented during the DoARS in Qatar.

Conclusion: The participation in the Decade of Action for Global Road Safety, by complying with the UN-recommended 5-pillars approach, by Qatar has resulted in reductions in road deaths and injuries that exceed the goals set by DoARS.

FROM TARGETS TO SOLUTIONS: IMPLEMENTING A TRAUMA QUALITY IMPROVEMENT BUNDLE IN CAMEROON

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Introduction: Global surgery research has been criticized for failing to transition from problem identification to solution implementation. A recent trauma quality improvement (TQI) program in Cameroon associated preventable deaths with deficiencies in primary survey evaluation and management. We introduced a context-specific TQI intervention to improve site-specific care gaps at a regional hospital in Cameroon.

Methods: Data on local trauma care practices were used to develop a bundle consisting of staff training, a trauma checklist, and monthly audit meetings. Trends in target process measures, including vital sign collection and primary survey performance, were compared between the six-month pre-intervention and post-intervention periods using chi-square analysis.

Results: Analysis included 246 pre-intervention and 217 post-intervention patients. Completion of all vital signs improved significantly after TQI implementation (Figure 1). Vital signs were measured more quickly (89% within 15 minutes vs. 78% pre-intervention, $p < 0.05$) and more frequently (53% with repeated vitals vs. 8%, $p < 0.01$). Primary survey assessment increasingly identified airway problems (8% vs. <1%, $p < 0.001$) and breathing problems (10% vs. 3%, $p < 0.001$) post-TQI, and interventions for respiratory issues (10% vs. 1%, $p < 0.001$) and cervical collar placement (8% vs. 0%, $p < 0.001$) were performed more frequently.

Conclusion: Implementation of a context-tailored TQI bundle was associated with significant improvements in previously identified target areas. Local data-derived interventions targeting frontline capacity can bridge the gap between recognized care deficits and tangible improvement in resource-limited settings.

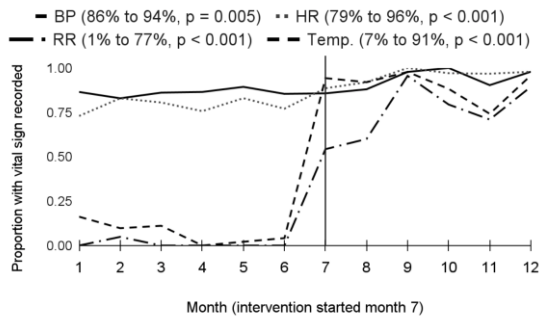


Figure 1: Frequency of vital sign collection pre- vs. post-intervention

ON MORTALITY RISK-ADJUSTMENT IN A CROSS-NATIONAL STUDY OF INJURED PATIENTS IN THE U.S. AND INDIA

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Introduction: Injury severity, typically measured by Injury Severity Score (ISS), is a major determinant of mortality after trauma. Adjusting for injury severity is essential when comparing mortality across different settings. Access to advanced imaging, critical for accurate ISS determination, is often severely limited in low/middle income countries (LMIC). Hence, ISS may not accurately reflect injury severity in these resource constrained environments. MGAP (Mechanism, Glasgow Coma Score, Age and blood Pressure), is not dependent upon imaging. The current study evaluates the accuracy of mortality prediction using MGAP versus ISS in an LMIC (India) and a high-income country (USA).

Methods: 2013-15 data from US National Trauma Data Bank (NTDB) and India Towards Improved Trauma Care Outcomes (TITCO) database was matched. Logistic regression models grouping patients within facilities were used to determine predictors of mortality. Models were varied to use ISS and MGAP for risk-adjustment, and the estimates compared. Inverse probability weighted regression adjustment (IPWRA) was used to estimate the population-level trauma mortality difference between the US and India.

Results: 687,407 adult patients (NTDB: 675,611; TITCO: 11,796) were included. Unadjusted mortality was significantly higher in India (23.15% vs 2.79% - $p < 0.001$). Overall, MGAP outperformed ISS for mortality prediction (AUROC 0.87 vs 0.81 - $p < 0.001$). In NTDB, both scores performed well, though MGAP was superior (AUROC 0.88 vs 0.85 - $p < 0.001$). In TITCO, while MGAP was highly predictive, ISS had poor predictability (AUROC 0.82 vs 0.58 - $p < 0.001$) - Fig. The odds of mortality in India were higher with ISS based risk adjustment (OR 15.61, 95% CI 12.83-18.99) vs MGAP (OR 9.73, 95% CI 7.48-12.65). Using IPWRA, the difference between MGAP and ISS persisted, with ISS models showing an 11.4% relative increase in estimated mortality probability.

Conclusions: In low resourced environments with limited access to imaging after trauma, anatomical scores (e.g. ISS) are highly inaccurate for risk adjustment. Non-anatomical risk scores not dependent upon imaging intensity such as MGAP are highly accurate and superior to ISS.

TRENDS OF TRAUMA ADMISSIONS TO ICU DURING PANDEMIC: A TIME SERIES ANALYSIS

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Introduction: During COVID-19 pandemic numerous modifications in management of patients was implemented in major trauma center to accommodate for the surge of ICU admissions while trauma admissions was at an all-time high. The aim of our study is to assess resource utilization during COVID-19 pandemic. We hypothesized that there was a decrease in ICU admissions among all trauma patients with similar characteristic during COVID-19 pandemic.

Methods: We performed a retrospective study of TQIP database (2017-2021), Patients admitted in 2017 - 2019 were defined as pre-pandemic period and 2020 and 2021 were defined as pandemic period. The primary outcomes were ICU admission. Secondary outcomes were mortality, hospital and ICU length of stay. Interrupted time series analysis was performed.

Results: Comparing pre-pandemic period to pandemic period patient attributes, and injury patterns were similar. Mortality rate was 3.5% on average. 59.3% of trauma patients were male and 74% were white. ICU admissions for trauma patient has been significantly reduced during pandemic (figure 1). While ICU length of stay remained similar ($5.05 + 6.7$ vs $5.23 + 6.8$) for admitted patients, hospital length of stay was shorter during pandemic ($5.3 + 8$ vs $4.1 + 5.1$).

Conclusion: ICU admissions of trauma patients have been declining over the years and this decline became steeper during pandemic. A natural hazardous phenomenon like pandemic which stressed healthcare systems nationwide triggered a rerouting of resource utilization, however outcomes for trauma patients remained similar.

