Trauma Care Without Residents, TQIP Non-Teaching Centers
TQIP at Level II Trauma Centers

Trauma Quality Improvement Program (TQIP) Annual Scientific Meeting and Training 2012
Chris Cribari, MD, FACS
Objectives

• Look at Level I vs II comparison of outliers
• Review and discuss the literature on outcomes from teaching versus nonteaching hospitals. Look at TQIP data comparing them.
• Raise questions on other relationships that need to be studied including the volume performance relationship
• What about Structure and Process
• Share my own center’s journey and lessons learned
Figure 18a. Risk Adjusted Mortality -
All patients excluding DIE/DOA (odd numbered IDs)
Figure 18b. Risk Adjusted Mortality: All patients excluding DIE/DOA (even numbered IDs)
All patients analysis: Level I and II outliers

<table>
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<th>Analysis</th>
<th>Level I</th>
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<th>Level II</th>
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= low outlier

= high outlier
Cohorts: Level I and II outliers

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<tr>
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Level I versus Level II

- In a mature trauma system, there is no difference in outcome (survival) between Level I and Level II trauma centers.

Rogers FB, Osler T, Lee JC, Sakorafas L, Wu D, Evans T, Edavettal M, Horst M.

Source
Division of Trauma/Critical Care, Lancaster General Health, Lancaster, Pennsylvania 17602, USA. frogers2@lghealth.org

Abstract
BACKGROUND:
The state of Pennsylvania (PA) has one of the oldest, most well-established trauma systems in the country. The requirements for verification for Level I versus Level II trauma centers within PA differ minimally (only in the requirement for patient volume, residency, and research). We hypothesized that there would be no difference in outcome at Level I versus Level II trauma centers.

METHODS:
Odds of mortality for 16 Level I and 11 Level II hospitals in PA over a 5-year period (2004-2008) was computed using a random effects logistic regression model. Overall adjusted mortality rates at Level I versus Level II hospitals were compared using the nonparametric Wilcoxon's rank sum test. The crude mortality rates for 140,691 patients over the 5-year period were similar (5.07% Level II vs. 5.48% Level I), but statistically significant (odds ratio mortality at Level I = 1.084, p = 0.002 Fisher's exact test).

RESULTS:
Although Level I centers had on average crude mortality rates that were higher than those of Level II centers, median adjusted mortality rates were not different for the two types of centers (Wilcoxon's rank sum test). Performance of Level I versus Level II shows considerable variability among centers (basic random effects model, age, blunt/penetrating, and Injury Severity Score [ISS]). However, Level II centers seem no different from Level I.

CONCLUSION:
As trauma systems mature, the distinction between Level I and Level II trauma centers blurs. The hierarchal descriptors "Level I" or "Level II" in a mature trauma system is pejorative and implies in those hospitals labeled "Level II" as inferior, and as such should be replaced with nonhierarchal descriptors.
Teaching versus Nonteaching Centers

• Problems with the literature

lack of definition as to what “teaching” means
medical students
nursing students
PA students
Resident education
Surgical Residents
Level of surgical resident on the trauma service
Trauma, Critical Care, Acute Care fellowship
Review of the literature - 132 studies (93 mortality)

- Patient outcomes with teaching versus nonteaching healthcare: a systematic review.
- Reviewed all studies that compared teaching versus nonteaching healthcare structures for mortality or any other patient outcome.
- Overall, 132 eligible studies were identified, including 93 on mortality and 61 on other eligible outcomes (22 addressed both).
- No differences were seen in the 14 studies fully adjusting for volume/experience, severity, and comorbidity (relative risk 1.01).
- Overall they do not suggest that a healthcare facility's teaching status on its own markedly improves or worsens patient outcomes.
Teaching versus Non-teaching Hospitals - Medical

- Severity-adjusted mortality and length of stay in teaching and nonteaching hospitals. Results of a regional study.
- Retrospective cohort study
- Thirty hospitals in northeast Ohio
- A total of 89851 consecutive eligible patients discharged in 1991 through 1993 with myocardial infarction, congestive heart failure, obstructive airway disease, gastrointestinal hemorrhage, pneumonia, or stroke.
- Mortality and LOS were lower for patients in major teaching hospitals than for patients in minor teaching and nonteaching hospitals
Teaching versus Non-teaching Hospitals - AAA

- Impact of hospital teaching status on survival from ruptured abdominal aortic aneurysm repair.
- Multi-level multivariable logistic regression
- Of 6636 open AAA repairs for rAAA, the overall perioperative mortality was 42%. Mortality was significantly lower at TH than non-TH (39.3% vs 44.5%; P < .05). Mortality was also lower at GSTH (38.7%) and VSTH (34.3%). After adjusting for hospital operative volume, patient demographics, and comorbidities, we found a 25% decrease in likelihood of in-hospital death at VSTH vs non-VSTH (odds ratio 0.75; 95% confidence interval 0.60-0.94; P < .05).
- CONCLUSION: In-hospital mortality is significantly reduced for patients undergoing open AAA repair for rAAA at teaching hospitals and hospitals with vascular surgery training programs, independent of volume.
Teaching versus Non-teaching Hospitals - Lung surgery

- Are surgical outcomes for lung cancer resections improved at teaching hospitals?
  - Meguid RA, Brooke BS, Chang DC, Sherwood JT, Brock MV, Yang SC.
  - Division of Thoracic Surgery, Johns Hopkins School of Medicine, Baltimore, Maryland 21287, USA.
  - Abstract
  - BACKGROUND:
    - Defining centers of excellence for complex surgical procedures, including pulmonary resection, reveals lower mortality at high-volume centers. We postulate that short-term outcome after lung cancer resection is better at teaching hospitals (TH) compared with nonteaching hospitals (non-TH), independent of volume.
  - METHODS:
    - Lung cancer resections in the Nationwide Inpatient Sample (NIS) dataset from 1998 to 2004 were stratified by resection type (segmentectomy, lobectomy, and pneumonectomy). The TH identified in the NIS include those with Accreditation Council for Graduate Medical Education-approved general surgery (GSTH) and thoracic surgery (TSTH) residency programs. The association of hospital teaching status with in-hospital mortality was assessed by multivariate logistic regression, adjusting for patient demographics and comorbidities.
  - RESULTS:
    - Of 46,951 lung resections (5,651 segmentectomies, 37,027 lobectomies, 4,273 pneumonectomies), 56% were performed at TH. Overall mortality was significantly lower at TH versus non-TH (3.2% vs 4.0%; p < 0.001). Subgroup analysis for GSTH and TSTH confirmed this decrease. On multivariate regression, overall odds of death was independently reduced by 17% at TH versus non-TH (95% confidence interval: 0.73 to 0.93; p = 0.002). At TH, odds of death for pneumonectomy and lobectomy were significantly reduced independent of surgical volume, except for the latter at the highest hospital volume strata.
  - CONCLUSIONS:
    - In-hospital mortality is reduced for patients undergoing lung cancer resections at teaching hospitals, with results prominent at all but the highest volume institutions. Lower mortality rates persisted at GSTH and TSTH. Understanding and disseminating the processes of care associated with these settings may improve quality of care for lung cancer patients, and decrease patient bias against teaching hospitals.
Teaching versus Non-teaching Hospitals - Cardiac Surgery


• Outcomes of concomitant aortic valve replacement and coronary artery bypass grafting at teaching hospitals versus nonteaching hospitals.

• Nationwide Inpatient Sample database

• Higher overall risk-adjusted complication rates in nonteaching hospitals (odds ratio 1.58; 95% confidence interval, 1.39-1.80; P < .0001) and teaching hospitals without a thoracic surgery residency program (odds ratio 1.42; 95% confidence interval, 1.26-1.60; P < .0001) than in thoracic surgery residency program hospitals.

• No difference was observed in the adjusted mortality rate for nonteaching hospitals (odds ratio 0.95; 95% confidence interval, 0.87-1.04; P = .25) or teaching hospitals without a thoracic surgery residency program (odds ratio 1.00; 95% confidence interval, 0.92-1.08; P = .98) when compared with thoracic surgery residency program hospitals. Robust statistical models were used for analysis, with c-statistics of 0.98 (complications) and 0.82 (mortality).

• CONCLUSION: Patients who require complex cardiac operations may have better outcomes when treated at teaching hospitals with a thoracic surgery residency program.
Teaching versus Nonteaching Hospitals - Pediatrics

• The association between hospital type and mortality among critically ill children in US EDs.
  Hansen M, Fleischman R, Meckler G, Newgard CD.
  Center for Policy and Research in Emergency Medicine, Department of Emergency Medicine, Oregon Health & Science University, Portland, OR, United States. Electronic address: hansemat@ohsu.edu.
  Abstract
  STUDY AIM:
  Little is known about the setting of care for critically ill children and whether differences in outcomes are related to the presenting hospital type. This study describes the characteristics of hospitals to which critically ill children present and explores the associations between hospital factors and mortality.
  METHODS:
  This is a retrospective cohort study using data from the 2007 Healthcare Cost and Utilization Project National Emergency Department Sample, representative of all US ED visits. Subjects include children aged 0-18 with ICD9 codes for cardiac arrest, respiratory arrest and/or respiratory failure. Predictor variables include: age, sex, presence of chronic illness, self-pay, public insurance, trauma diagnosis, major trauma center, urban hospital, ED volume and teaching hospital. Multivariate logistic regression estimates predictors of mortality. Analyses integrate clusters, strata, and weights from the probability sample.
  RESULTS: There were an estimated 29 million pediatric ED visits in 2007 including 42,036 (0.1%) visits for cardiac or respiratory failure. Teaching hospitals (OR 0.57, 95% CI 0.50-0.66), trauma centers (OR 0.76, 95% CI 0.67-0.86), and urban hospitals (OR 0.78, 95% CI 0.63-0.97) were associated with lower mortality odds. Presence of a chronic illness (OR 14.5, 95% CI 10.5-20.1), diagnosis of an injury (OR 1.2, 95% CI 1.1-1.4) and self-pay status (OR 3.6, 95% CI 2.9-4.4) were associated with increased mortality odds.
  CONCLUSIONS:
  The majority of children with cardiac and respiratory arrest present to urban teaching hospitals and trauma centers. After accounting for important confounders, mortality is lower at teaching hospitals and/or major trauma centers.
What about for trauma patients?

Level II Trauma Centers - Teaching versus Nonteaching

- Divided into
  - ACS - University and Community - teaching
  - ACS - Nonteaching
  - State designated - University and Community - teaching
  - State designated - Nonteaching
Risk Adjusted Mortality: All Patients
Excluding those classified as DOA or died in the ED

![Graph showing O/E ratio with 95% CI for different categories of TQIP Report ID.

ACS Level II: University and Community
ACS Level II: Non-teaching
State Level II: University and Community
State Level II: Non-teaching

American College of Surgeons
Inspiring Quality: Highest Standards, Better Outcomes
Trend for higher likelihood as a good performer if the Level II is ACS verified and a University or Community teaching hospital.
Teaching versus Nonteaching Hospitals - Trauma

- Arch Surg. 2012 Sep 1;147(9):856-62.
- Influence of resident involvement on trauma care outcomes.
- Bukur M, Singer MB, Chung R, Ley EJ, Malinoski DJ, Margulies DR, Salim A.
- Abstract
- HYPOTHESIS Discrepancies exist in complications and outcomes at teaching trauma centers (TTCs) vs nonteaching TCs (NTCs). DESIGN Retrospective review of the National Trauma Data Bank research data sets (January 1, 2007, through December 31, 2008). SETTING Level II TCs. PATIENTS Patients at TTCs were compared with patients at NTCs using demographic, clinical, and outcome data. Regression modeling was used to adjust for confounding factors to determine the effect of house staff presence on failure to rescue, defined as mortality after an in-house complication. MAIN OUTCOME MEASURES The primary outcome measures were major complications, in-hospital mortality, and failure to rescue. RESULTS In total, 162,687 patients were available for analysis, 36,713 of whom (22.6%) were admitted to NTCs. Compared with patients admitted to TTCs, patients admitted to NTCs were older (52.8 vs 50.7 years), had more severe head injuries (8.3% vs 7.8%), and were more likely to undergo immediate operation (15.0% vs 13.2%) or ICU admission (28.1% vs 22.8%) (P < .01 for all). The mean Injury Severity Scores were similar between the groups (10.1 for patients admitted to NTCs vs 10.4 for patients admitted to TTCs, P < .01). Compared with patients admitted to TTCs, patients admitted to NTCs experienced fewer complications (adjusted odds ratio [aOR], 0.63; P < .01 for all), had a lower adjusted mortality rate (aOR, 0.87; P < .01), and were less likely to experience failure to rescue (aOR, 0.81; P < .01).

- CONCLUSIONS Admission to level II TTCs is associated with an increased risk for major complications and a higher rate of failure to rescue compared with admission to level II NTCs. Further investigation of the differences in care provided by level II TTCs vs NTCs may identify areas for improvement in residency training and processes of care.
Teaching versus Non-teaching hospitals - Cost?

- Med Care. 1985 Apr;23(4):283-95
- Case-mix and cost differences between teaching and nonteaching hospitals
- 11 teaching and 20 nonteaching hospitals are compared, using the original 383 diagnosis-related groups (DRGs) to analyze the extent to which case-mix differences contribute to differences in average cost per case.
- The **average cost per case is more than 60% more expensive in teaching hospitals**. Only approximately one quarter of this higher cost is accounted for by case-mix differences.
So What about VOLUME??
Volume-outcome Relationships

- Hospital volume and surgical mortality in the United States.
  - Birkmeyer JD, Siewers AE, Finlayson EV, Stukel TA, Lucas FL, Batista I, Welch HG, Wennberg DE.
  - Veterans Affairs Outcomes Group, Department of Veterans Affairs Medical Center, White River Junction, VT 05009, USA.
  - john.birkmeyer@dartmouth.edu
- Abstract
  - BACKGROUND:
    - Although numerous studies suggest that there is an inverse relation between hospital volume of surgical procedures and surgical mortality, the relative importance of hospital volume in various surgical procedures is disputed.
  - METHODS:
    - Using information from the national Medicare claims data base and the Nationwide Inpatient Sample, we examined the mortality associated with six different types of cardiovascular procedures and eight types of major cancer resections between 1994 and 1999 (total number of procedures, 2.5 million). Regression techniques were used to describe relations between hospital volume (total number of procedures performed per year) and mortality (in-hospital or within 30 days), with adjustment for characteristics of the patients.
  - RESULTS:
    - Mortality decreased as volume increased for all 14 types of procedures, but the relative importance of volume varied markedly according to the type of procedure. Absolute differences in adjusted mortality rates between very-low-volume hospitals and very-high-volume hospitals ranged from over 12 percent (for pancreatic resection, 16.3 percent vs. 3.8 percent) to only 0.2 percent (for carotid endarterectomy, 1.7 percent vs. 1.5 percent). The absolute differences in adjusted mortality rates between very-low-volume hospitals and very-high-volume hospitals were greater than 5 percent for esophagectomy and pneumonectomy, 2 to 5 percent for gastrectomy, cystectomy, repair of a nonruptured abdominal aneurysm, and replacement of an aortic or mitral valve, and less than 2 percent for coronary-artery bypass grafting, lower-extremity bypass, colectomy, lobectomy, and nephrectomy.
  - CONCLUSIONS:
    - In the absence of other information about the quality of surgery at the hospitals near them, Medicare patients undergoing selected cardiovascular or cancer procedures can significantly reduce their risk of operative death by selecting a high-volume hospital.
Volume-outcome relationship

- The relationship between annual hospital volume of trauma patients and in-hospital mortality in New York State.
  
  
  Source
  
  Department of Surgery and Critical Care, SUNY Upstate Medical University, Syracuse, New York 13210, USA. William.marx@va.gov
  
  Abstract
  
  BACKGROUND:
  
  Several studies in the literature have examined the volume-outcome relationship for trauma, but the findings have been mixed, and the associated impact of the trauma center level has not been examined to date. The purposes of this study are to (1) determine whether there is a significant relationship between the annual volume of trauma inpatients treated in a trauma center (with "patients" defined in multiple ways) and short-term mortality of those patients, and (2) examine the impact on the volume-mortality relationship of being a Level I versus Level II trauma center.
  
  METHODS:
  
  Data from New York's Trauma Registry in 2003 to 2006 were used to examine the impact of total trauma patient volume and volume of patients with Injury Severity Score (ISS) of at least 16 on in-hospital mortality rates after adjusting for numerous risk factors that have been demonstrated to be associated with mortality.
  
  RESULTS:
  
  The adjusted odds of in-hospital mortality patients in centers with a mean annual volume of less than 2,000 patients was significantly higher (adjusted odds ratio = 1.46, 95% confidence interval, 1.25-1.71) than the odds for patients in higher volume centers. The adjusted odds of mortality for patients in centers with an American College of Surgeons-recommended annual volume of less than 240 patients with an ISS of at least 16 was 1.41 times as high (95% confidence interval, 1.17-1.69) as the odds for patients in higher volume centers. However, for both volume cohorts analyzed, the variation in risk-adjusted in-hospital mortality rate was greater among centers within each volume subset than between these volume subsets.
  
  CONCLUSION:
  
  When considering the trauma system as a whole, higher total annual trauma center volume (2,000 or higher) and higher volume of patients with ISS ≥16 (240 and higher) are significant predictors of lower in-hospital mortality. Although the American College of Surgeons-recommended 1,200 total volume is not a significant predictor, hospitals in New York with ISS ≥16 volumes in excess of 240 also have total volumes in excess of 2,000. However, when considering individual trauma centers, high volume centers do not consistently perform better than low volume centers. Thus, despite the association between volume and mortality, we believe that the most accurate way to assess trauma center performance is through the use of an accurate, complete, comprehensive database for computing center-specific risk-adjusted mortality rates, rather than volume per se.
How busy is too busy? Depends on what we measure!

- Volume-related differences in emergency department performance.
- Welch SJ, Augustine JJ, Dong L, Savitz LA, Snow G, James BC.
- Institute for Health Care Delivery Research, Intermountain Healthcare, Salt Lake City, Utah, USA. sharijwelch@gmail.com
- Abstract
- BACKGROUND:
  Emergency departments (EDs) are an important source of care for a large segment of the population of the United States. In 2009 there were more than 136 million visits to the ED each year, and more than half of hospital admissions begin in the ED. Measurement and monitoring of emergency department performance has been prompted by The Joint Commission’s patient flow standards. A study was conducted to attempt to correlate ED volume and other operating characteristics with performance on metrics.
- METHODS:
  A retrospective analysis of the Emergency Department Benchmarking Alliance annual ED survey data for the most recent year for which data were available (2009) was performed to explore observed patterns in ED performance relative to size and operating characteristics. The survey was based on 14.6 million ED visits in 358 hospitals across the United States, with an ED size representation (sampling) approximating that of the Emergency Medicine Network (EM Net).
- RESULTS:
  Larger EDs (with higher annual volumes) had longer lengths of stay (p < .0001), higher left without being seen rates (p < .0001), and longer door-to-physician times (p < .0001), all suggesting poorer operational performance. Operating characteristics indicative of higher acuity were associated with worsened performance on metrics and lower acuity characteristics with improved performance.
- CONCLUSION:
  ED volume, which also correlates with many operating characteristics, is the strongest predictor of operational performance on metrics and can be used to categorize EDs for comparative analysis. Operating characteristics indicative of acuity also influence performance. The findings suggest that ED performance measures should take ED volume, acuity, and other characteristics into account and that these features have important implications for ED design, operations, and policy decisions.
Structure matters!!!! Nursing staff

• BMC Health Serv Res. 2012 Aug 9;12:247.
• The association between nurse staffing and hospital outcomes in injured patients.
  - Glance LG, Dick AW, Osler TM, Mukamel DB, Li Y, Stone PW.
  - Departments of Anesthesiology, and Community and Preventive Medicine, University of Rochester School of Medicine, Rochester, NY, USA. laurent_glance@urmc.rochester.edu.
  - Abstract
  - BACKGROUND:
    - The enormous fiscal pressures facing trauma centers may lead trauma centers to reduce nurse staffing and to make increased use of less expensive and less skilled personnel. The impact of nurse staffing and skill mix on trauma outcomes has not been previously reported. The goal of this study was to examine whether nurse staffing levels and nursing skill mix are associated with trauma patient outcomes.
  - METHODS:
    - We used data from the Healthcare Cost and Utilization Project Nationwide Inpatient Sample to perform a cross-sectional study of 70,142 patients admitted to 77 Level I and Level II centers. Logistic regression models were used to examine the association between nurse staffing measures and (1) mortality, (2) healthcare associated infections (HAI), and (3) failure-to-rescue. We controlled for patient risk factors (age, gender, injury severity, mechanism of injury, comorbidities) and hospital structural characteristics (trauma center status - Level I versus Level II, hospital size, ownership, teaching status, technology level, and geographic region).
  - RESULTS:
    - A 1% increase in the ratio of licensed practical nurse (LPN) to total nursing time was associated with a 4% increase in the odds of mortality (adj OR 1.04; 95% CI: 1.02-1.06; p = 0.001) and a 6% increase in the odds of sepsis (adj OR 1.06; 1.03-1.10; p < 0.001). Hospitals in the highest quartile of LPN staffing had 3 excess deaths (95% CI: 1.2, 5.1) and 5 more episodes of sepsis (95% CI: 2.3, 7.6) per 1000 patients compared to hospitals in the lower quartile of LPN staffing.

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Structure - In-house Attending


• Impact of the in-house trauma surgeon on initial patient care, outcome, and cost.
  
  Luchette F, Kelly B, Davis K, Johanningman J, Heink N, James L, Ottaway M, Hurst J.
  
  Source
  
  Department of Surgery, University of Cincinnati College of Medicine, OH 45267-0558, USA.
  
  Abstract
  
  BACKGROUND:
  
  The purpose of this study is to evaluate the effect of having attending trauma surgeons with added qualifications in surgical critical care present for the initial resuscitation at a regional trauma center.
  
  METHODS:
  
  This study is a retrospective review of patients admitted between August of 1994 and December of 1995 from our trauma registry. The patients were categorized by the call preference of the admitting physician as in-house (IH) or call-back from home (CB), day of admission (weekend vs. weekday), time of admission (AM vs. PM), and a value of the injury severity scale < or = 15 or > 15. Demographics, admission vital signs, Injury Severity Scale, Glasgow Coma Score, and elapsed time to diagnostic, therapeutic, and/or operative interventions were studied. The effect on intensive care unit length of stay, mortality, and hospital cost for resuscitation were also studied.
  
  RESULTS:
  
  The study population consisted of 1,043 patients. The IH and CB groups each included two attending surgeons. IH significantly reduced the average time to completion of diagnostic peritoneal lavage (22 vs. 34 minutes; p < 0.05), therapeutic intervention (21 vs 38 minutes; p < 0.05), and transport to the operating room (206 vs. 312 minutes; p < 0.05) during the AM compared with CB. There was no difference in these times for the PM admissions. There was no significant difference in intensive care unit length of stay. Among patients with severe head and thoracoabdominal injury (Abbreviated Injury Score > 4 and 3, respectively) there was no difference in mortality. Analysis of cost for emergency room resuscitation in severely injured patients (Injury Severity Score > or = 15), seen during weekdays, was significantly less when evaluated by IH (IH = $5,097 vs. CB = $6,779; p < 0.05).
  
  CONCLUSIONS:
  
  During the initial resuscitation of patients with severely injured during the weekdays, IH significantly reduced the cost, and elapsed time to diagnostic testing, therapeutic intervention, and to the operating room, respectively. IH reduced fatalities compared with CB.
Structure - In-house Attending

- Trauma faculty and trauma team activation: impact on trauma system function and patient outcome.
  - Khetarpal S, Steinbrunn BS, McGonigal MD, Stafford R, Ney AL, Kalb DC, West MA, Rodriguez JL.
  - Department of Surgery, St. Paul Ramsey Medical Center, University of Minnesota, St. Paul, USA.
  - Abstract
  - OBJECTIVE:
    To determine the impact of the presence of an attending trauma surgeon during trauma team activation on system function and patient outcome.
  - METHODS:
    After a retrospective review of medical records and trauma registry, a comparative study between two American College of Surgeons Committee on Trauma Level I trauma centers was performed. One center (Hennepin County Medical Center) required a chief surgical resident, two junior residents, and a board-certified emergency medicine faculty to be present in the emergency department for all trauma team activations. The attending trauma surgeon was notified at the time of trauma team activation and was neither required to be present in the emergency department at time of patient arrival nor in the hospital 24 h/day. The other center (St. Paul Ramsey Medical Center) required a chief surgical resident, two junior residents, a board-certified emergency medicine faculty member, and an attending trauma surgeon to be present in the emergency department for all trauma activations and in hospital 24 hours/day. Over a 21-month period, all major trauma patients (Injury Severity Score > 15 or emergent operation within 4 hours of admission and any Injury Severity Score) that triggered trauma team activation were examined. Resuscitation time, time to incision, probability of survival, and mortality were analyzed.
  - RESULTS:
    Resuscitation time was shorter at St. Paul Ramsey Medical Center when compared with Hennepin County Medical Center. Analysis by mechanism of injury demonstrates that this was true for blunt trauma (39+/−13 vs. 27+/−12 minutes, p = 0.001) and for penetrating trauma (28+/−14 vs. 24+/−17 minutes, p = 0.01). Subgroup analysis of penetrating trauma victims demonstrated that there was a significant difference in resuscitation times for gunshot wounds but not for stabs. There was no difference in how quickly operations could be initiated for blunt trauma patients. However, in penetrating cases, time to incision was significantly shorter at St. Paul Ramsey Medical Center (50+/−29 vs. 66+/−43 minutes, p = 0.01). There was no significant difference in mortality for any category of Trauma and Injury Severity Score probability of survival in blunt or penetrating trauma. Analysis of “in-house” and “out-house” time intervals demonstrated no difference in survival in any mechanism of injury, nor was there a difference in overall mortality.
  - CONCLUSION:
    The presence of a trauma surgeon on the trauma team reduced resuscitation time and reduced time to incision for emergent operations, particularly in penetrating trauma. However, it had no measurable impact on mortality based on Trauma and Injury Severity Score probability of survival. Attending trauma surgeon presence on the trauma team improves in-hospital trauma system function without affecting patient outcome.

• Increased mortality in patients with severe traumatic brain injury treated without intracranial pressure monitoring.

• Farahvar A, Gerber LM, Chiu YL, Carney N, Härtl R, Ghajar J.
• Department of Neurosurgery, University of Rochester Medical Center, Rochester;
• Abstract
• Object Evidence-based guidelines recommend intracranial pressure (ICP) monitoring for patients with severe traumatic brain injury (TBI), but there is limited evidence that monitoring and treating intracranial hypertension reduces mortality. This study uses a large, prospectively collected database to examine the effect on 2-week mortality of ICP reduction therapies administered to patients with severe TBI treated either with or without an ICP monitor. Methods From a population of 2134 patients with severe TBI (Glasgow Coma Scale [GCS] Score <9), 1446 patients were treated with ICP-lowering therapies. Of those, 1202 had an ICP monitor inserted and 244 were treated without monitoring. Patients were admitted to one of 20 Level I and two Level II trauma centers, part of a New York State quality improvement program administered by the Brain Trauma Foundation between 2000 and 2009. This database also contains information on known independent early prognostic indicators of mortality, including age, admission GCS score, pupillary status, CT scanning findings, and hypotension. Results Age, initial GCS score, hypotension, and CT scan findings were associated with 2-week mortality. In addition, patients of all ages treated with an ICP monitor in place had lower mortality at 2 weeks (p = 0.02) than those treated without an ICP monitor, after adjusting for parameters that independently affect mortality. Conclusions In patients with severe TBI treated for intracranial hypertension, the use of an ICP monitor is associated with significantly lower mortality when compared with patients treated without an ICP monitor. Based on these findings, the authors conclude that ICP-directed therapy in patients with severe TBI should be guided by ICP monitoring.
Processes of Care Matter!!!!

- Decreased Intracranial Pressure Monitor Use At Level II Trauma Centers Is Associated with Increased Mortality.
- Barmparas G, Singer M, Ley E, Chung R, Malinoski D, Margulies D, Salim A, Bukur M.
- Division of Acute Care Surgery, Cedars-Sinai Medical Center, Los Angeles, California, USA.
- Abstract
- Previous investigations suggest outcome differences at Level I and Level II trauma centers. We examined use of intracranial pressure (ICP) monitors at Level I and Level II trauma centers after traumatic brain injury (TBI) and its effect on mortality. The 2007 to 2008 National Trauma Databank was reviewed for patients with an indication for ICP monitoring based on Brain Trauma Foundation (BTF) guidelines. Demographic and clinical outcomes at Level I and Level II centers were compared by regression modeling. Overall, 15,921 patients met inclusion criteria; 11,017 were admitted to a Level I and 4,904 to a Level II trauma center. Patients with TBI admitted to a Level II trauma center had a lower rate of Injury Severity Score greater than 16 (80 vs 82%, P < 0.01) and lower frequency of head Abbreviated Injury Score greater than 3 (80 vs 82%, P < 0.01). After regression modeling, patients with TBI admitted to a Level II trauma center were 31 per cent less likely to receive an ICP monitor (adjusted odds ratio [AOR], 0.69; P < 0.01) and had a significantly higher mortality (AOR, 1.12; P < 0.01). Admission to a Level II trauma center after severe TBI is associated with a decreased use of ICP monitoring in patients who meet BTF criteria as well as an increased mortality. These differences should be validated prospectively to narrow these discrepancies in care and outcomes between Level I and Level II centers.
Processes of Care Matter!!!!

- Trauma team oversight improves efficiency of care and augments clinical and economic outcomes.
  - Davis KA, Cabbad NC, Schuster KM, Kaplan LJ, Carusone C, Leary T, Udelsman R.
  - Department of Surgery, Section of Trauma, Surgical Critical Care and Surgical Emergencies, Yale University School of Medicine, New Haven, Connecticut 06520-8062, USA. kimberly.davis@yale.edu
  - BACKGROUND:
    - The purpose of this study was to determine whether trauma team oversight of patient management would positively affect efficiency of care as defined by improved patient throughput, with augmentation of both clinical and economic outcomes.
  - METHODS:
    - All patients activating the trauma team at a level I trauma center during two time periods (last 6 months of 2005 and 2006) were reviewed. Trauma team activation criteria remained constant across the two time periods. During period one, patients were admitted to multiple services depending on injury pattern, whereas in period two, most patients were admitted to the trauma service for trauma team oversight of their management. In period two, improved documentation and appropriate coding were encouraged. Data are reported as mean +/- SD, and median.
  - RESULTS:
    - Patient demographics, number of full-time trauma surgeons, and payer mix were similar during the two time periods. Trauma activations increased 150% (p < 0.05). The percentage of patients admitted to the trauma service increased (68% vs. 86%, p < 0.001). Median injury severity score (ISS) of admitted patients was unchanged, although mean ISS decreased (15 +/- 15 vs. 12 +/- 11, p < 0.0001). Hospital length of stay decreased (12 +/- 55 vs. 6 +/- 11, p < 0.0001). Linear regression analysis identified ISS and admission during the later time period as significant predictors of decreased length of stay. Changes in billings and coding practices resulted in statistically significant increases in trauma surgeon work-related relative value units (182% increase), charges (360% increase), and collections (280% increase). The increased system efficiency resulted in significant decreases in the actual hospital costs per patient and led to the generation of an overall net positive hospital contribution margin per patient.
  - CONCLUSIONS:
    - Implementation of trauma team oversight of patient care resulted in increased efficiency of care delivery, with shorter hospital lengths of stay despite increased patient volume. This paradigm change, coupled with improved documentation and coding, resulted in improved reimbursement for the physician, and lower cost per discharge for the hospital.
ACS verification matters

- Commitment to COT verification improves patient outcomes and financial performance.
  - Maggio PM, Brundage SI, Hernandez-Boussard T, Spain DA.
  - Source
  - Department of Surgery, Stanford University School of Medicine, Stanford, California 94305, USA. pmaggio@stanford.edu
  - BACKGROUND:
  - After an unsuccessful American College of Surgery Committee on Trauma visit, our level I trauma center initiated an improvement program that included (1) hiring new personnel (trauma director and surgeons, nurse coordinator, orthopedic trauma surgeon, and registry staff), (2) correcting deficiencies in trauma quality assurance and process improvement programs, and (3) development of an outreach program. Subsequently, our trauma center had two successful verifications. We examined the longitudinal effects of these efforts on volume, patient outcomes and finances.
  - METHODS:
  - The Trauma Registry was used to derive data for all trauma patients evaluated in the emergency department from 2001 to 2007. Clinical data analyzed included number of admissions, interfacility transfers, injury severity scores (ISS), length of stay, and mortality for 2001 to 2007. Financial performance was assessed for fiscal years 2001 to 2007. Data were divided into patients discharged from the emergency department and those admitted to the hospital.
  - RESULTS:
  - Admissions increased 30%, representing a 7.6% annual increase (p = 0.004), mostly due to a nearly fivefold increase in interfacility transfers. Severe trauma patients (ISS >24) increased 106% and mortality rate for ISS >24 decreased by 47% to almost half the average of the National Trauma Database. There was a 78% increase in revenue and a sustained increase in hospital profitability.
  - CONCLUSION:
  - A major hospital commitment to Committee on Trauma verification had several salient outcomes; increased admissions, interfacility transfers, and acuity. Despite more seriously injured patients, there has been a major, sustained reduction in mortality and a trend toward decreased intensive care unit length of stay. This resulted in a substantial increase in contribution to margin (CTM), net profit, and revenues. With a high level of commitment and favorable payer mix, trauma center verification improves outcomes for both patients and the hospital.
ACS COT PIPS program matters!!!! Most?

- American College of Surgeons' Committee on Trauma Performance Improvement and Patient Safety program: maximal impact in a mature trauma center.

- Division of Acute Care Surgery, Department of Surgery, University of Michigan, Ann Arbor, Michigan, USA.

**BACKGROUND:**
To examine the impact of an ongoing comprehensive performance improvement and patient safety (PIPS) program implemented in 2005 on mortality outcomes for trauma patients at an established American College of Surgeons (ACS)-verified Level I Trauma Center.

**METHODS:**
The primary outcome measure was in-hospital mortality. Age, Injury Severity Score (ISS), and intensive care unit admissions were used as stratifying variables to examine outcomes over a 5-year period (2004-2008). Institution mortality rates were compared with the National Trauma Data Bank mortality rates stratified by ISS score. Enhancements to our comprehensive PIPS program included revision of trauma activation criteria, development of standardized protocols for initial resuscitation, massive transfusion, avoidance of over-resuscitation, tourniquet use, pelvic fracture management, emphasis on timely angiographic and surgical intervention, prompt spine clearance, reduction in time to computed tomography imaging, reduced dwell time in emergency department, evidence-based traumatic brain injury management, and multidisciplinary efforts to reduce healthcare-associated infections.

**RESULTS:**
In 2004 (baseline data), the in-hospital mortality rate for the most severely injured trauma patients (ISS >24) at our trauma center was 30%, consistent with the reported mortality rate from the National Trauma Data Bank for patients with this severity of injury. Over 5 years, our mortality rate decreased significantly for severely injured patients with an ISS >24, from 30.1% (2004) to 18.3% (2008), representing a 12% absolute reduction in mortality (p = 0.011). During the same 5-year time period, the proportion of elderly patients (age >65 years) cared for at our trauma center increased from 23.5% in 2004 to 30.6% in 2008 (p = 0.0002). Class I trauma activations increased significantly from 5.5% in 2004 to 15.5% in 2008 based on our reclassification. A greater percentage of patients were admitted to the intensive care unit (25.8% in 2004 to 37.3% in 2007 and 30.4% in 2008). No difference was identified in the rate of blunt (95%) or penetrating (5%) mechanism of injury in our patients over this time period. Trauma Quality Improvement Program confirmed improved trauma outcomes with observed-to-expected ratio and 95% confidence intervals of 0.64 (0.42-0.86) for all patients, 0.54 (0.15-0.91) for blunt single-system patients, and 0.78 (0.51-1.06) for blunt multisystem patients.

**CONCLUSION:**
Implementation of a multifaceted trauma PIPS program aimed at improving trauma care significantly reduced in-hospital mortality in a mature ACS Level I trauma center. Optimal care of the injured patient requires uncompromising commitment to PIPS.
Variations in the care provided on different units?

- Variations in levels of care within a hospital provided to acute trauma patients.
- Stewart WW, Farina Z, Clarke DL, Thomson SR.
- University of Pretoria.

**Abstract**

**INTRODUCTION:**
Caring for trauma patients is a dynamic process, and it is often necessary to move the trauma patient around the hospital to different locations. This study attempted to document the quality of observations performed on acute trauma patients as they moved through the hospital during the first 24 hours of care.

**METHODODOLOGY:**
This study was a student elective and was undertaken at Grey’s Hospital, Pietermaritzburg. A third-year medical student was assigned to follow acute trauma patients throughout the hospital during the first 24 hours after admission. This single independent observer recorded the frequency with which vital signs were recorded at each geographical location in the hospital for each patient. A scoring system was devised to classify the quality of the observations that each patient received in the different departments. The observer recorded all the geographical movements each patient made during the first 24 hours after admission.

**RESULTS:**
Fifteen patients were recruited into this study over a 4-week period. There were 14 adult males (average age 28 years, range 18 - 56 years) and a 7-year-old girl in the cohort. There were significant differences in the quality of the observations, depending on the geographical location in the hospital. These variations and differences were consistent in certain locations and highly variable in others. Observations in the intensive care unit (ICU) and operating theatre were uniformly excellent. In the radiology suite the level of observations was universally poor. In casualty and the wards there was great variability in the level of observation. A total of 45 distinct geographical visits were made by the study cohort. Each patient made an average of 3 (range 2 - 5) visits during their first 24 hours after admission. All patients attended casualty, and there were 11 patient visits to the ward, 10 to radiology, 4 to ICU and 5 to theatre.

**CONCLUSION:**
Significant variations exist in the level of observations of vital signs between different geographical locations within the hospital. This is problematic, as acute trauma patients need to be moved around the hospital as part of their routine care. If observations are not done and acted upon, subtle clinical deterioration may be overlooked and overt deterioration may be heralded by a catastrophic event.
Timeliness of Care !!!

- The performance and assessment of hospital trauma teams.
  - Georgiou A, Lockey DJ.
  - Frenchay Hospital, Bristol BS16 1LE, UK.
  - The purpose of the trauma team is to provide advanced simultaneous care from relevant specialists to the seriously injured trauma patient. When functioning well, the outcome of the trauma team performance should be greater than the sum of its parts. Trauma teams have been shown to reduce the time taken for resuscitation, as well as time to CT scan, to emergency department discharge and to the operating room. These benefits are demonstrated by improved survival rates, particularly for the most severely injured patients, both within and outside of dedicated trauma centres. In order to ensure the best possible performance of the team, the leadership skills of the trauma team leader are essential and their non-technical skills have been shown to be particularly important. Team performance can be enhanced through a process of audit and assessment of the workings of the team and the evidence currently available suggests that this is best facilitated through the process of video review of the trauma resuscitation. The use of human patient simulators to train and assess trauma teams is becoming more commonplace and this technique offers a safe environment for the future education of trauma team staff. Trauma teams are a key component of most programmes which set out to improve trauma care. This article reviews the background of trauma teams, the evidence for benefit and potential techniques of performance assessment. The review was written after a PubMed, Ovid, Athens, Cochrane and guideline literature review of English language articles on trauma teams and their performance and hand searching of references from the relevant searched articles.
Better outcomes equals lower cost!!!

- **The association between cost and quality in trauma: is greater spending associated with higher-quality care?**
  - Glance LG, Dick AW, Osler TM, Meredith W, Mukamel DB.
  - Source
  - Department of Anesthesiology, University of Rochester School of Medicine, University of Rochester Medical Centre, Rochester, NY, USA. Laurent_Glance@urmc.rochester.edu
  - BACKGROUND:
    - Current efforts to reduce health care costs and improve health care quality require a better understanding of the relationship between cost and quality.
  - METHODS:
    - Using data from the Healthcare Cost and Utilization Projects Nationwide Inpatient Sample, we performed a retrospective observational study of 67,124 trauma patients admitted to 73 trauma centers. Generalized linear models were used to explore the association between hospital cost and in-hospital mortality, controlling for hospital and patient factors as follows: injury diagnoses, age, gender, mechanism of injury, comorbidities, teaching status, hospital ownership, geographic region, and hospital wages.
  - RESULTS:
    - Patients treated in hospitals with low risk-adjusted mortality rates had significantly lower costs than those treated in average-quality hospitals. The relative cost of patients treated in high-quality hospitals was 0.78 (95% confidence interval: 0.64, 0.95) compared with average-quality hospitals. The cost of treating patients in average- and high-mortality trauma centers was similar.
  - CONCLUSION: In this study based on the Healthcare Cost and Utilization Project Nationwide Inpatient Sample, the care of injured patients is less expensive in hospitals with lower risk-adjusted mortality rates. Hospitals with low risk-adjusted mortality rates have adjusted mortality rates that are 34% lower while spending nearly 22% less compared with average-quality hospitals.
Leapfrog Safe Practices

- JAMA. 2009 Apr 1;301(13):1341-8.
- Association between hospital-reported Leapfrog Safe Practices Scores and inpatient mortality.

- Kernisan LP, Lee SJ, Boscardin WJ, Landefeld CS, Dudley RA.
- Source
- Division of Geriatrics, University of California, San Francisco, USA.
- Abstract
- CONTEXT:
  - The Leapfrog Hospital Survey allows hospitals to self-report the steps they have taken toward implementing the Safe Practices for Better Healthcare endorsed by the National Quality Forum. The Leapfrog Group currently ranks hospital performance on the safe practices initiative by quartiles and presents this information to the public on its Web site. It is unknown how well a hospital's resulting Safe Practices Score (SPS) correlates with outcomes such as inpatient mortality.
- OBJECTIVE:
  - To determine the relationship between hospitals' SPSs and risk-adjusted inpatient mortality rates.
- DESIGN, SETTING, AND PARTICIPANTS:
  - Observational analysis of discharge data for all urban US hospitals completing the 2006 safe practices initiative and identifiable in the Nationwide Inpatient Sample. Leapfrog provided an SPS for each hospital as well as 3 alternative scores based on shorter versions of the original survey. Hierarchical logistic regression was used to determine the relationship between quartiles of SPS and risk-adjusted inpatient mortality, after adjusting for hospital discharge volume and teaching status. Subgroup analyses were performed using data from patients older than 65 years and patients with 5% or greater expected mortality risk.
- MAIN OUTCOME MEASURES:
  - Inpatient risk-adjusted mortality by quartiles of survey score.
- RESULTS:
  - Of 1075 hospitals completing the 2006 Safe Practices Survey, 155 (14%) were identifiable in the National Inpatient Sample (1,772,064 discharges). Raw observed mortality in the primary sample was 2.09%. Fully adjusted mortality rates by quartile of SPS, from lowest to highest, were 1.97% (95% confidence interval [CI], 1.78%-2.18%), 2.04% (95% CI, 1.84%-2.25%), 1.96% (95% CI, 1.77%-2.16%), and 2.00% (95% CI, 1.80%-2.22%) (P = .99 for linear trend). Results were similar in the subgroup analyses. None of the 3 alternative survey scores was associated with risk-adjusted inpatient mortality, although P values for linear trends were lower (.80, .20, and .11).
- CONCLUSION:
  - In this sample of hospitals that completed the 2006 Safe Practices Survey, survey scores were not significantly associated with risk-adjusted inpatient mortality.
Lessons Learned

• Simply participating in quality projects does not improve quality
• You must actively search for opportunities for improvement and do something to improve and then restudy it (PDCA)
Trauma Center of the Rockies at Medical Center of the Rockies
Risk Adjusted Mortality: All Patients
Excluding those classified as DOA or died in the ED
Risk Adjusted Mortality: Blunt Multisystem Injuries
Including those classified as DOA or died in the ED

O/E ratio with 95% CI
Risk Adjusted Mortality: Penetrating Injuries
Including those classified as DOA or died in the ED
Length of Stay - Pneumothorax

Proportion of Cases with Excess LOS with 95% CI vs TQIP Report ID
Drill Down

- Identified cross-walking problem from AIS 05 which included patients with more severe chest injury with those of simple pneumothorax.

- Also identified significant variability in the processes of care of patients with a chest tube.
Length of Stay

Figure 28. Isolated chest injuries with pneumothorax

2011 Data
Lessons learned

• Any given report is just a snap shot in time
• Must drill down
• More value in the trend and restudy after change has been implemented
• Opportunity to review clinical practice guidelines and revise based on best practices of others
Figure 2.5:
Risk Adjusted Mortality: Blunt Multisystem Injury (even # centers)

*indicates that the center has no deaths
#indicates that the center has no deaths and the upper limit of CI is above 3
Figure 2.7:
Risk Adjusted Mortality: Penetrating Injury (even # centers)

*Indicates that the center has no deaths
#indicates that the center has no deaths and the upper limit of CI is above 4
Risk Adjusted Mortality: Penetrating Injuries
Including those classified as DOA or died in the ED
Figure 2.7:
Risk Adjusted Mortality: Penetrating Injury (even # centers)

O/E ratio with 95% CI

TQIP Report ID

* Indicates that the center has no deaths
# Indicates that the center has no deaths and the upper limit of CI is above 4
2010 Penetrating Trauma

- Inclusion criteria: penetrating mechanism only, admitted; penetrating trauma to neck, abdomen or thorax, ISS >9 or AIS >3 (isolated penetrating trauma to head excluded)

- 12 total patients

- 3 (25% of total penetrating population died in the ED: all deaths with this group occurred in ED)
## 2010 TQIP Report Penetrating MCR Trauma (Including Deaths in ED)

<table>
<thead>
<tr>
<th>2010 Patient ID</th>
<th>Age</th>
<th>NTDB ISS</th>
<th>NISS</th>
<th>Mortality</th>
<th>Probability of Death %</th>
<th>Probability of Survival %</th>
<th>Excess LOS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>27</td>
<td>9 (25)</td>
<td>34</td>
<td>died in ed</td>
<td>93.75</td>
<td>11.37</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>49</td>
<td>26 (27)</td>
<td>27</td>
<td>died in ed</td>
<td>99.14</td>
<td>0.9</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>36</td>
<td>50</td>
<td>57</td>
<td>died in ed</td>
<td>99.25</td>
<td>0.3</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>46</td>
<td>9 (16)</td>
<td>16</td>
<td>NA</td>
<td>0.3</td>
<td>99.74</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>22</td>
<td>10 (16)</td>
<td>5</td>
<td>NA</td>
<td>0.37</td>
<td>99.95</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>43</td>
<td>10 (17)</td>
<td>29</td>
<td>NA</td>
<td>3.32</td>
<td>99.69</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>28</td>
<td>11</td>
<td>14</td>
<td>NA</td>
<td>5.08</td>
<td>99.71</td>
<td>0</td>
</tr>
<tr>
<td>8</td>
<td>30</td>
<td>16 (29)</td>
<td>50</td>
<td>NA</td>
<td>81.9</td>
<td>53.66</td>
<td>0</td>
</tr>
<tr>
<td>9</td>
<td>52</td>
<td>16</td>
<td>34</td>
<td>NA</td>
<td>3.37</td>
<td>NA (unable to calculate RTS with out ED RR)</td>
<td>0</td>
</tr>
<tr>
<td>10</td>
<td>23</td>
<td>22 (17)</td>
<td>22</td>
<td>NA</td>
<td>8.78</td>
<td>99.69</td>
<td>0</td>
</tr>
<tr>
<td>11</td>
<td>25</td>
<td>38 (45)</td>
<td>50</td>
<td>NA</td>
<td>32.53</td>
<td>8.49</td>
<td>1 (19)</td>
</tr>
<tr>
<td>12</td>
<td>78</td>
<td>45 (41)</td>
<td>48</td>
<td>NA</td>
<td>95.29</td>
<td>0.81</td>
<td>0</td>
</tr>
</tbody>
</table>
The Probability of Death of those who died were 93.75%, 99.14% & 99.25%

AIS 98 used in ISS scoring by TQIP

3 (33%) of patients who lived also had high probability of death percentage (95.29%, 81.9% and 32.53%)

1 patient with excess LOS
2011 Penetrating Trauma

- Inclusion criteria: penetrating mechanism only, admitted; penetrating trauma to neck, abdomen or thorax, ISS >9 or AIS >3 (isolated penetrating trauma to head excluded)
- 7 total patients
- 1 (14%) death after family opted for comfort cares
- 2 patients with excess LOS
- AIS 05 used in ISS scoring
# 2011 Data for 2012 TQIP Report

## Penetrating Trauma

<table>
<thead>
<tr>
<th>2011 Patient ID</th>
<th>Age</th>
<th>NTDB ISS</th>
<th>NISS</th>
<th>Mortality</th>
<th>Probability of Death %</th>
<th>Probability of Survival %</th>
<th>Excess LOS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20</td>
<td>9 (8)</td>
<td>12</td>
<td>NA</td>
<td>0.0019</td>
<td>99.0</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>18</td>
<td>11 (5)</td>
<td>12</td>
<td>NA</td>
<td>0.0046</td>
<td>99.95</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>22</td>
<td>9</td>
<td>18</td>
<td>NA</td>
<td>0.0161</td>
<td>99.91</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>65</td>
<td>9</td>
<td>13</td>
<td>NA</td>
<td>0.0053</td>
<td>98.70</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>21</td>
<td>34 (29)</td>
<td>33</td>
<td>NA</td>
<td>0.0158</td>
<td>87.58</td>
<td>1 (34)</td>
</tr>
<tr>
<td>6</td>
<td>23</td>
<td>14</td>
<td>14</td>
<td>1 (pt made comfort cares) died from anoxic brain</td>
<td>0.0606</td>
<td>98.13</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>41</td>
<td>20</td>
<td>34</td>
<td>NA</td>
<td>0.0801</td>
<td>99.52</td>
<td>1 (16)</td>
</tr>
<tr>
<td></td>
<td>Acute Renal Failure</td>
<td>Cardiac Arrest with CPR</td>
<td>Decub Ulcer</td>
<td>Deep Surgical Site Infection</td>
<td>Drug or ETOH W/Drawal</td>
<td>DVT</td>
<td>Extremity Compartment Syndrome</td>
</tr>
<tr>
<td>----------------------</td>
<td>---------------------</td>
<td>-------------------------</td>
<td>-------------</td>
<td>------------------------------</td>
<td>------------------------</td>
<td>-----</td>
<td>--------------------------------</td>
</tr>
<tr>
<td><strong>ALL</strong></td>
<td>1.2</td>
<td>2.6</td>
<td>1.4</td>
<td>1.0</td>
<td>0.3</td>
<td>1.8</td>
<td>0.3</td>
</tr>
<tr>
<td><strong>MCR</strong></td>
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<td>0.0</td>
<td>0.0</td>
<td>0.2</td>
<td>0.0</td>
<td>0.7</td>
<td>0.0</td>
</tr>
</tbody>
</table>
Decreased Variability of Care

- Increased Quality and Outcomes
- Decreased Cost
- Better Value