



**M·TQIP**

**Individual Site Summary Report**

**July 1, 2014 through September 30, 2016**

**Issued February 14, 2017**

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## **Description of Cohorts**

### **Cohort 1 (All)**

- 1) Mechanism = Blunt or penetrating
- 2) Age  $\geq$  18, Age  $\geq$  16 starting 1/1/13
- 3) ISS  $\geq$  5
- 4) Hospital LOS  $\geq$  1 day or dead

### **Cohort 1 (All) w/o DOA's**

- 1) Mechanism = Blunt or penetrating
- 2) Age  $\geq$  18, Age  $\geq$  16 starting 1/1/13
- 3) ISS  $\geq$  5
- 4) Hospital LOS  $\geq$  1 day or dead
- 5) Exclude patients who had no signs of life

### **Cohort 2 (Admit trauma)**

- 1) Mechanism = Blunt or penetrating
- 2) Age  $\geq$  18, Age  $\geq$  16 starting 1/1/13
- 3) ISS  $\geq$  5
- 4) Hospital LOS  $\geq$  1 day or dead
- 5) Admit to trauma service if ED disposition not death

### **Cohort 2 (Admit trauma) w/o DOA's**

- 1) Mechanism = Blunt or penetrating
- 2) Age  $\geq$  18, Age  $\geq$  16 starting 1/1/13
- 3) ISS  $\geq$  5
- 4) Hospital LOS  $\geq$  1 day or dead
- 5) Exclude patients who had no signs of life
- 6) Admit to trauma service if ED disposition not death

### **Cohort 3 (Blunt Multi-System)**

- 1) Mechanism = Blunt
- 2) Age  $\geq$  18, Age  $\geq$  16 starting 1/1/13
- 3) ISS  $\geq$  5
- 4) Hospital LOS  $\geq$  1 day or dead
- 5) Exclude patients who had no signs of life
- 6) AIS  $\geq$  3 in at least two of the following body regions: head/neck, face, chest, abdomen, extremities, or external.

### **Cohort 4 (Blunt Single-System)**

- 1) Mechanism = Blunt
- 2) Age  $\geq$  18, Age  $\geq$  16 starting 1/1/13
- 3) ISS  $\geq$  5
- 4) Hospital LOS  $\geq$  1 day or dead

- 5) Exclude patients who had no signs of life
- 6) AIS  $\geq 3$  limited to only one body region with all other body regions having a maximum AIS  $\leq 2$  in the following body regions: head/neck, face, chest, abdomen, extremities, or external.

#### **Mortality or Hospice**

- 1) Mechanism = Blunt or penetrating
- 2) Age  $\geq 18$ , Age  $\geq 16$  starting 1/1/13
- 3) ISS  $\geq 5$
- 4) Hospital LOS  $\geq 1$  day or dead
- 5) Exclude patients who had no signs of life
- 6) Outcome is dead or discharge to hospice

#### **Cohort 5 (Penetrating)**

- 1) Mechanism = Penetrating
- 2) Age  $\geq 18$ , Age  $\geq 16$  starting 1/1/13
- 3) ISS  $\geq 5$
- 4) Hospital LOS  $\geq 1$  day or dead
- 5) Exclude patients who had no signs of life

#### **Cohort 6 (Admit non-trauma Service)**

- 1) Mechanism = Blunt or Penetrating
- 2) Age  $\geq 18$ , Age  $\geq 16$  starting 1/1/13
- 3) ISS  $\geq 5$
- 4) Hospital LOS  $\geq 1$  day or dead
- 5) Admit to non-trauma service if ED disposition not death
- 6) Exclude patients who had no signs of life

#### **Cohort 7 (Benchmark)**

- 1) Age  $\geq 16$
- 2) ISS  $\geq 9$
- 3) Exclude patients who had no signs of life
- 4) Exclude patients who were transferred out
- 5) Exclude patients discharged directly from the ED alive
- 6) Exclude patients with an advanced directive limiting care present prior to injury
- 7) Exclude patients who sustain a hip fracture and fall and age  $\geq 65$

Note: this benchmark may not match your national benchmark report exactly. The MTQIP uses AIS 2005. The national benchmark uses ICD-9 with crosswalk to AIS 1998.

#### **ISS > 35 Mortality**

- 1) Mechanism = Blunt or penetrating
- 2) Age  $\geq 18$ , Age  $\geq 16$  starting 1/1/13
- 3) ISS > 35

- 4) Hospital LOS  $\geq$  1 day or dead
- 5) Exclude patients who had no signs of life

#### **Age < 65 Mortality**

- 1) Mechanism = Blunt or penetrating
- 2) Age  $\geq$  18, Age  $\geq$  16 starting 1/1/13 and Age < 65
- 3) ISS  $\geq$  5
- 4) Hospital LOS  $\geq$  1 day or dead
- 5) Exclude patients who had no signs of life

#### **Age $\geq$ 65 Mortality**

- 1) Mechanism = Blunt or penetrating
- 2) Age  $\geq$  65
- 3) ISS  $\geq$  5
- 4) Hospital LOS  $\geq$  1 day or dead
- 5) Exclude patients who had no signs of life

#### **Mortality Trend**

- 1) Cohort 2
- 2) Exclude patients who had no signs of life

#### **Complications Trend**

- 1) Cohort 2
- 2) Exclude patients who had no signs of life

#### **Complications**

- 1) Cohort 2 w/o DOA's
- 2) Complication severity grade 1
  - a. Definition: Non-life-threatening complications
  - b. Complications: catheter-related bloodstream infection, C. difficile colitis, deep SSI, drug or alcohol withdrawal syndrome, graft/prosthesis/flap failure, organ/space SSI, acute renal insufficiency, osteomyelitis, superficial SSI, unplanned return to ICU, urinary tract infection, wound disruption
- 3) Complication severity grade 2
  - a. Definition: Potentially life-threatening complications
  - b. Complications: decubitus ulcer, DVT, enterocutaneous fistula, extremity compartment syndrome, pneumonia, pulmonary embolism, unplanned intubation, unplanned return to OR
- 4) Complication severity grade 3
  - a. Definition: Life-threatening complications with residual or lasting disability or mortality
  - b. Complications: acute lung injury/ARDS, acute kidney injury, cardiac arrest with CPR, mortality, myocardial infarction, severe sepsis, stroke/CVA
- 5) Specific complication groups

- a. Any complication = Grade 1 + Grade 2 + Grade 3 (excluding death)
- b. Serious = Grade 2 + Grade 3 (excluding death)
- c. Cardiac/Stroke = stroke/CVA, cardiac arrest requiring CPR, myocardial infarction
- d. Pneumonia = pneumonia
- e. DVT/Pulmonary Embolus = DVT lower extremity, DVT upper extremity, pulmonary embolism
- f. UTI = urinary tract infection
- g. Renal Failure = acute kidney injury
- h. Sepsis = sepsis
- i. C. Difficile Colitis = C. diff

**Failure to Rescue**

- 1) Mechanism = Blunt or penetrating
- 2) Age  $\geq$  18, Age  $\geq$  16 starting 1/1/13
- 3) ISS  $\geq$  5
- 4) Hospital LOS  $\geq$  1 day or dead
- 5) Exclude patients who had no signs of life
- 6) Admit to trauma service if ED disposition not death
- 7) Exclude patients who did not have a severity grade 2 or 3 complication
- 8) Failure to rescue = n dead with complication / n with complication

Note: A patient can have four possible combinations: dead/no complication, dead/complication, alive/no complication, or alive/complication. Failure to rescue is the percent of patients with an identified complication who go on to die.

**Unplanned Return to OR**

- 1) Cohort 2
- 2) Exclude patients who had no signs of life
- 3) Unplanned return to OR = Y

**Unplanned Return to ICU**

- 1) Cohort 2
- 2) Exclude patients who had no signs of life
- 3) Unplanned return to ICU = Y

**Hospital Length of Stay**

- 1) Cohort 2
- 2) Exclude all deaths

**Intensive Care Unit Length of Stay**

- 1) Cohort 2
- 2) Exclude all deaths
- 3) Exclude all patients with ICU LOS < 1

### **Patients Admitted to ICU**

- 1) Cohort 1
- 2) Exclude patients who had no signs of life
- 3) ICU days > 0

### **Mechanical Ventilator Days**

- 1) Cohort 2
- 2) Exclude patients who had no signs of life
- 3) Exclude all patients with Mechanical Ventilator Days < 1

### **VAP**

- 1) Cohort 2
- 2) Exclude patients who had no signs of life
- 3) Exclude patients with Mechanical Ventilator Days < 1

### **Patients on Ventilator**

- 1) Cohort 1
- 2) Exclude patients who had no signs of life
- 3) Mechanical Ventilator days > 0

### **IVC Filter**

- 1) Cohort 1
- 2) Exclude patients who had no signs of life
- 3) Op Code 38.7

### **VTE**

- 1) Cohort 2
- 2) Patients who received heparin, LMWH, or no VTE prophylaxis from ED admit date and time
- 3) Exclude all patients who arrived in ED prior to 1/1/12
- 4) Exclude patient who had no signs of life
- 5) Exclude patients who died in ED
- 6) Exclude patients who received direct thrombin inhibitor, oral Xa inhibitor, Coumadin, or other

### **ICP Monitor and/or Brain Operation**

- 1) Cohort 1
- 2) Mechanism = Blunt
- 3) AIS Head  $\geq 1$ , excluding vascular, scalp, and bony injuries
- 4) Exclude if TBI GCS > 8
- 5) Exclude patients who had no signs of life
- 6) Exclude patients who were transferred late (Direct admit)

### **Blood**

- 1) Cohort 1
- 2) PRBC 4 hours  $\geq 5$  units

### **Hemorrhage Control Angiography/Operation**




- 1) Cohort 1
- 2) Lowest systolic BP  $\leq$  90 in ED
- 3) Exclude if first angiography/operation < 0 or > 24 hours

### **No Signs of Life**

Patients will be designated as having arrived to the ED with “no signs of life” if they meet one of the following criteria and die in the ED

- 1) ED SBP=0, HR=0, and GCS=3
- 2) ED SBP=0, HR=0, and mGCS=1
- 3) ED SBP=NK/NR, HR=0, and mGCS=1
- 4) ED SBP=0, HR=0, and mGCS=NK/NR
- 5) ED SBP=0, HR=NK/NR, and mGCS=1
- 6) ED SBP=NK/NR, HR=0, and mGCS=NK/NR

### **Legend**

-  Low-outlier status (better performance)
-  Non-outlier status (average performance)
-  High-outlier status (worse performance)



## Statistical Methods

We performed risk and reliability adjustment using a two stage approach. Multivariate logistic regression modeling was used to account for differences in baseline characteristics and injury severity, thereby allowing for risk-adjustment at the patient level. Potential predictors of for the outcome of interest were entered into the model. A logit equation was derived based on the significant co-variables using forward selection. Separate models for each outcome were constructed and the order of variable entry was determined by the c-index which measures the ability of a parameter to discriminate outcome. Reliability adjustment used a Bayesian random effects model to account for sample size differences between hospitals. Logit equations resulting from second stage models were used to calculate expected outcome risk. Adjusted rates for each hospital were calculated by multiplying the rate ratio of observed to expected events by the overall collaborative rate

In some instances, specific incidents had missing values for potentially important co-variables (Glasgow Coma Scale (GCS) motor score, systolic blood pressure, and pulse rate). These attributes were identified and managed via the creation an indicator variable where applicable. The final model and analysis included all of the incidents that met MTQIP entry criteria for the cohort being examined.

Continuous data exhibiting a right-skewed distribution such as hospital length of stay was natural log-transformed. Multivariate analysis of hospital length of stay, intensive care unit length of stay, and mechanical ventilator days was performed using multiple linear regression and adjusting for significant co-variables. After the regression analysis was conducted the generated coefficient from the regression model was exponentiated to determine the percent increase or decrease in length of stay relative to the risk adjusted mean. Only patients who survived were considered in the hospital and ICU length of stay analysis to simplify this approach. To be included in the ICU length of stay or mechanical ventilator days' analysis, a patient had to have at least one day of use for the resource being investigated.

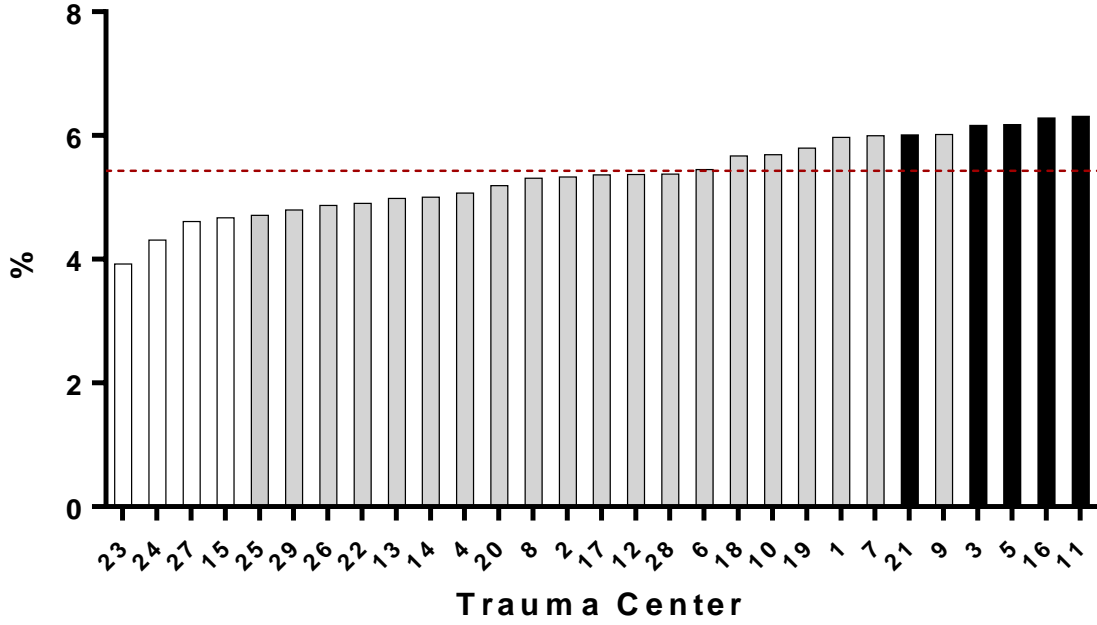
Eligible = N - Alive w/o intervention - Dead and monitor withheld for reason

Eligible and no intervention = N - Alive w/o intervention - Alive with intervention - Dead with intervention - Dead and monitor withheld for reason

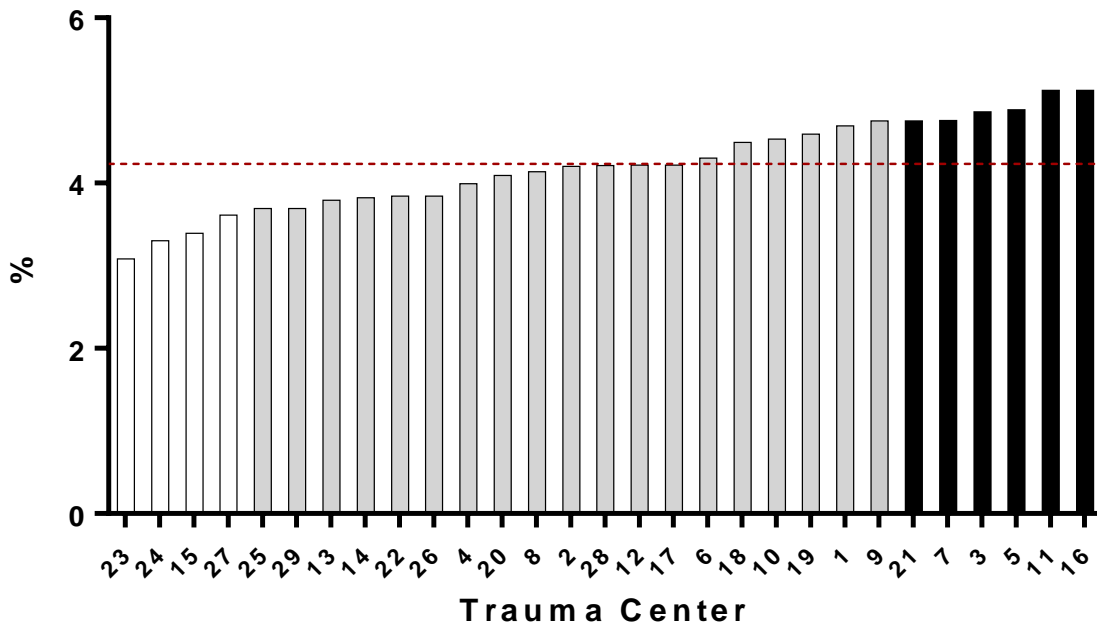
Timely = Monitor placement or operation  $\leq$  8 hours after ED arrival

Mortality Graphs

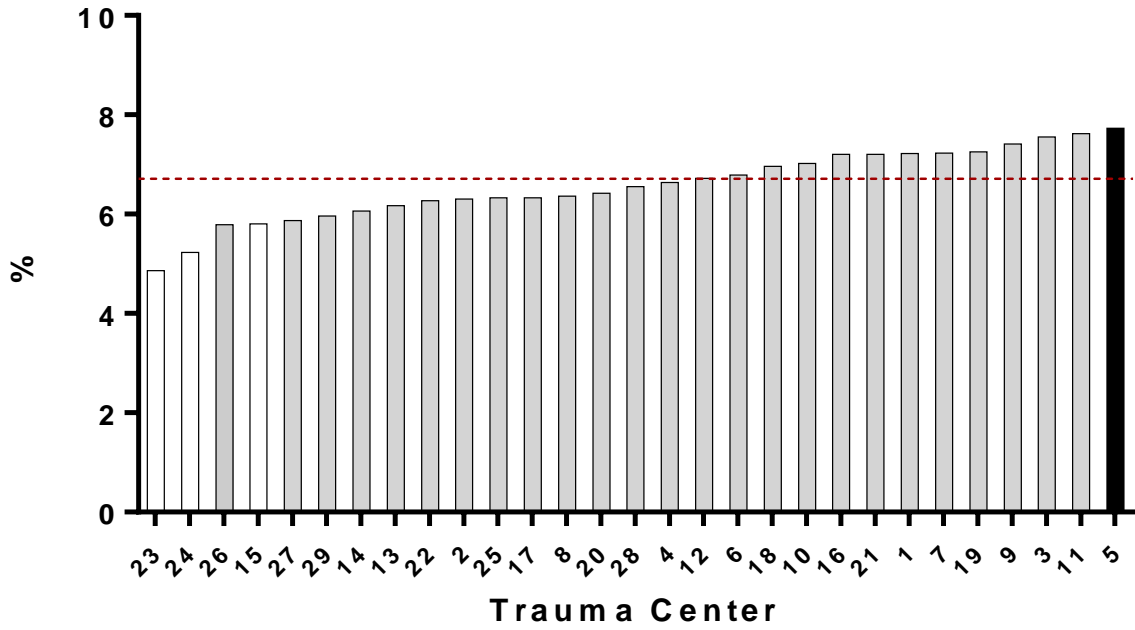
Mortality (Cohort 1)



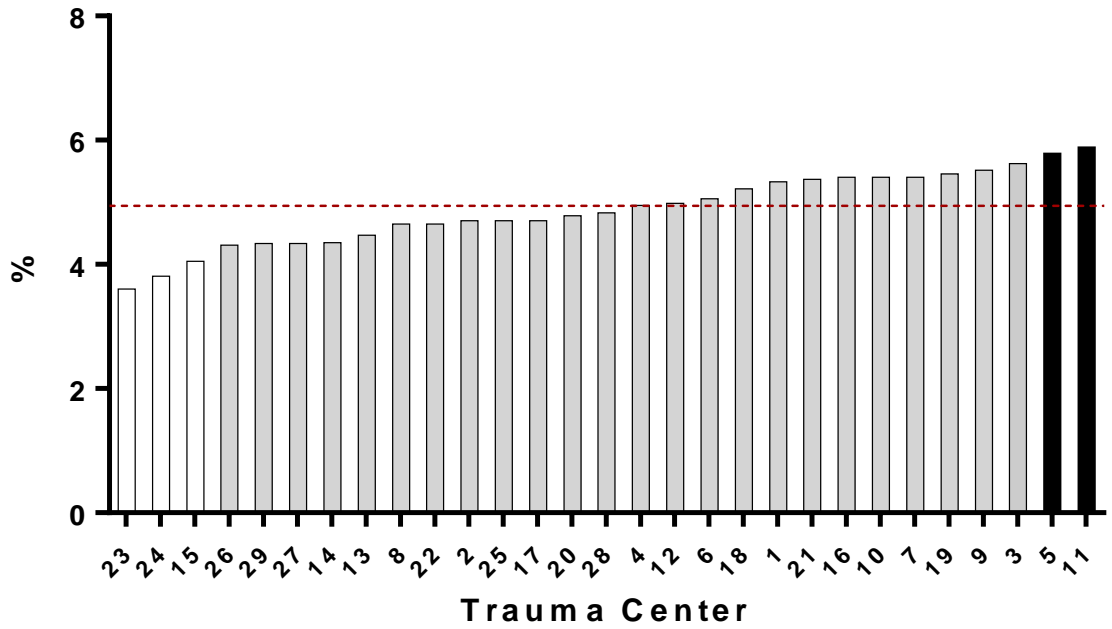
Mortality (Cohort 1 w/o DOA's)



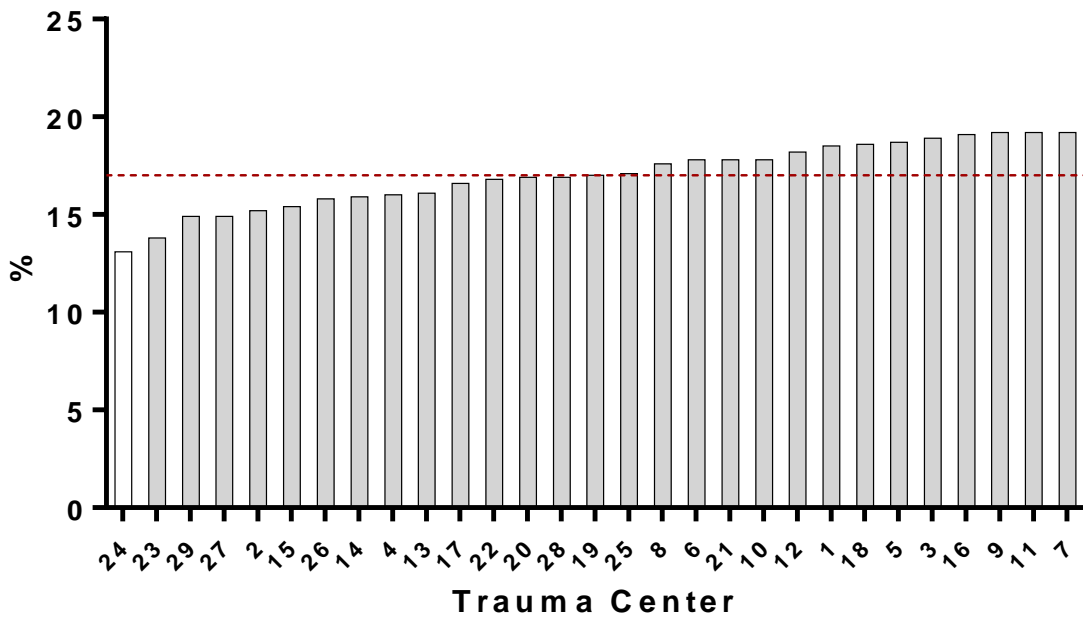
### Mortality (Cohort 2)



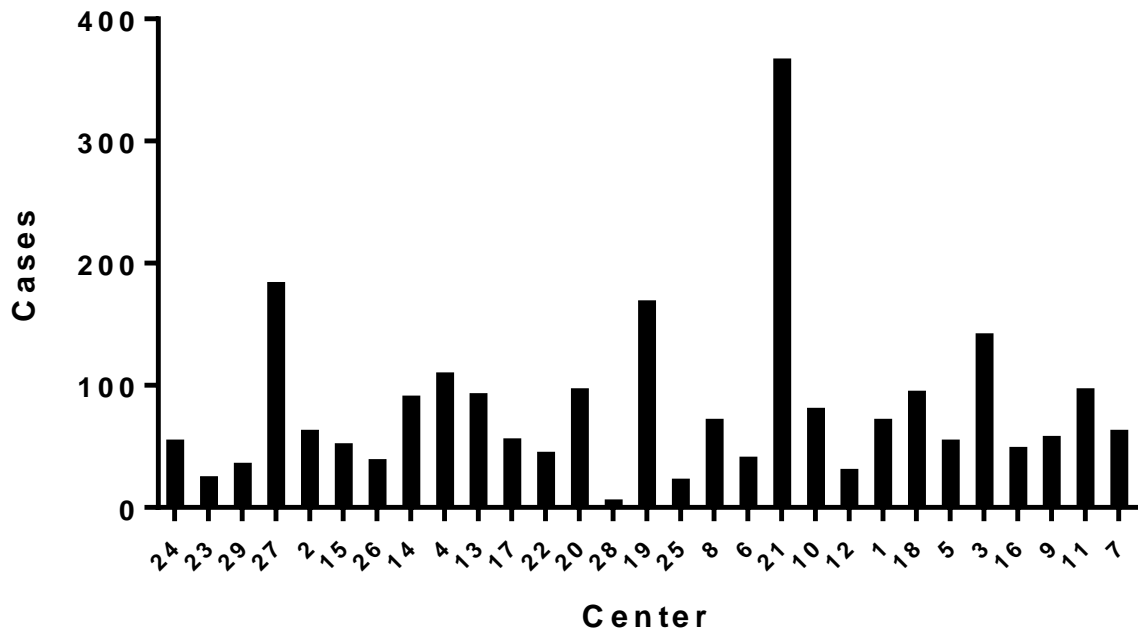
### Mortality (Cohort 2 w/o DOA's)



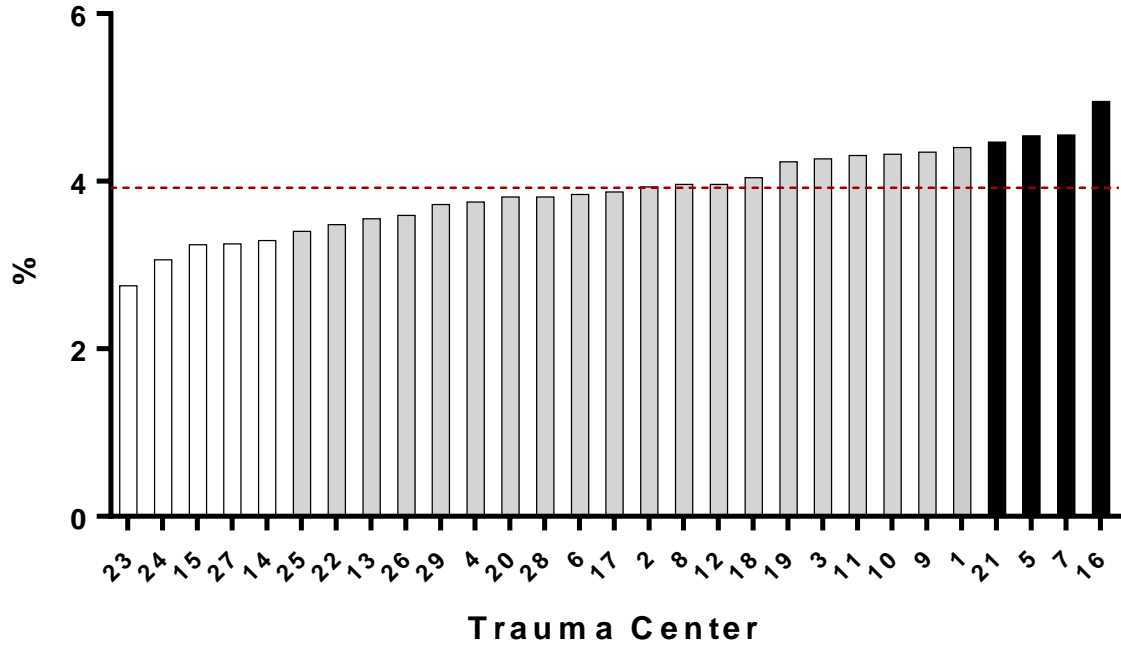
### Mortality (Cohort 3 - Blunt Multi w/o DOA's)



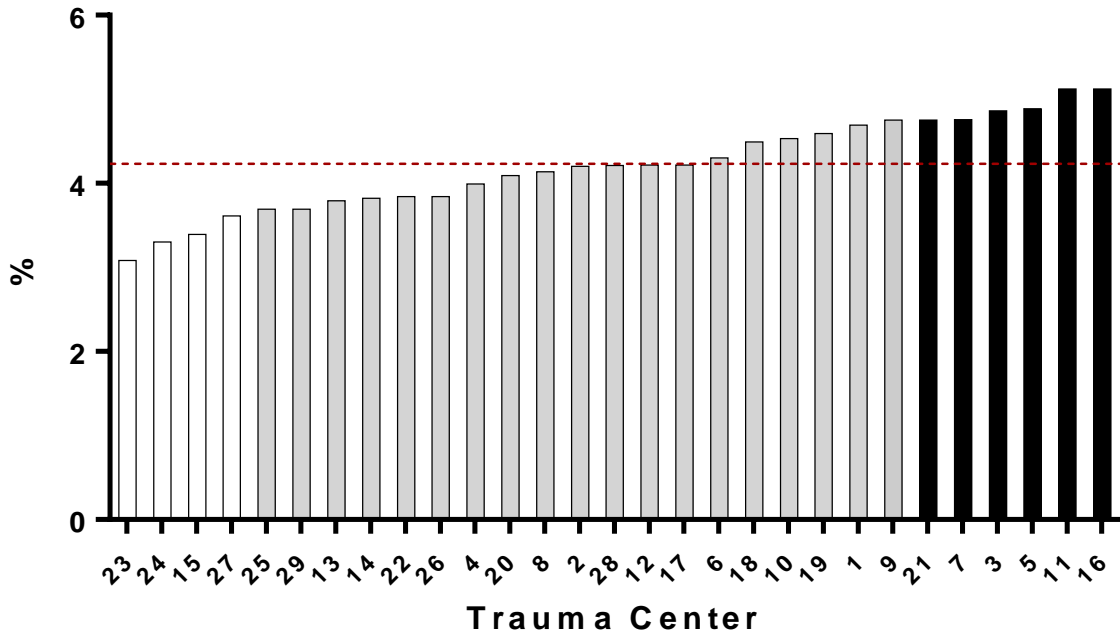
### Case Volume Mortality (Cohort 3)



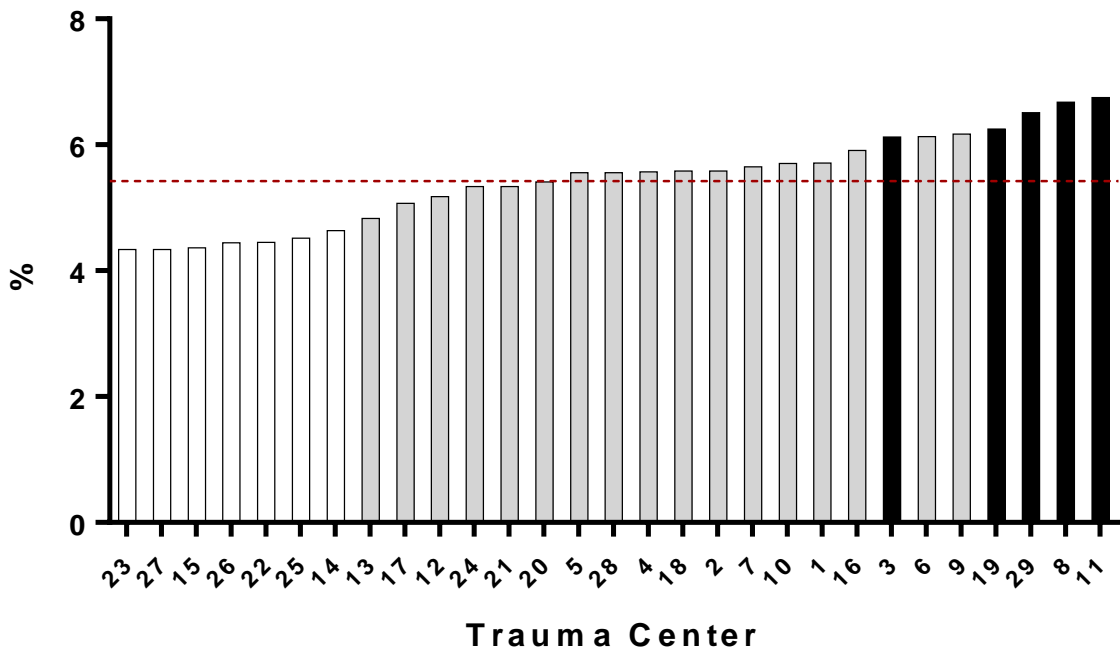
### Mortality (Cohort 4 - Blunt Single w/o DOA's)



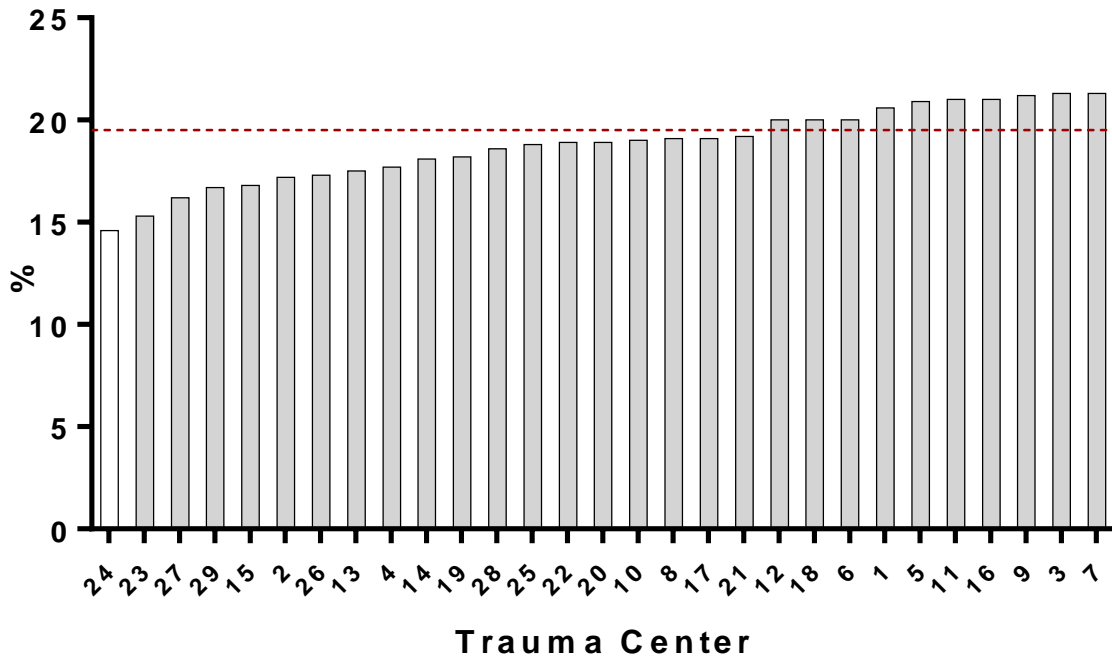
### Mortality (Cohort 1 w/o DOA's)



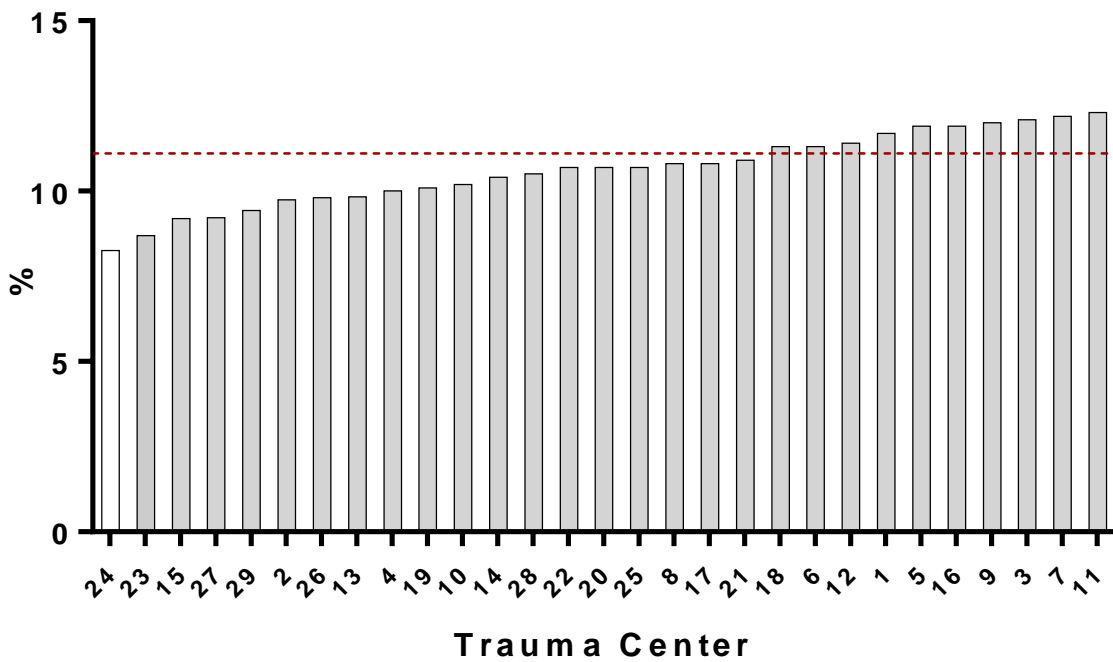
### Mortality or Hospice (Cohort 1 w/o DOA's)



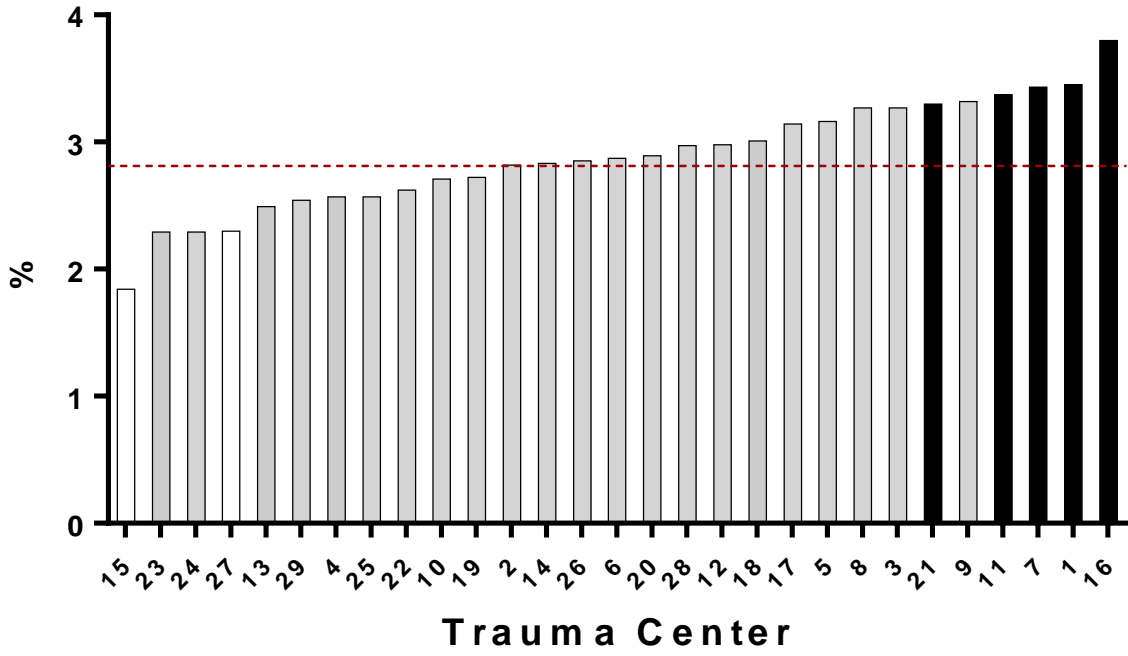
### Mortality (Penetrating)



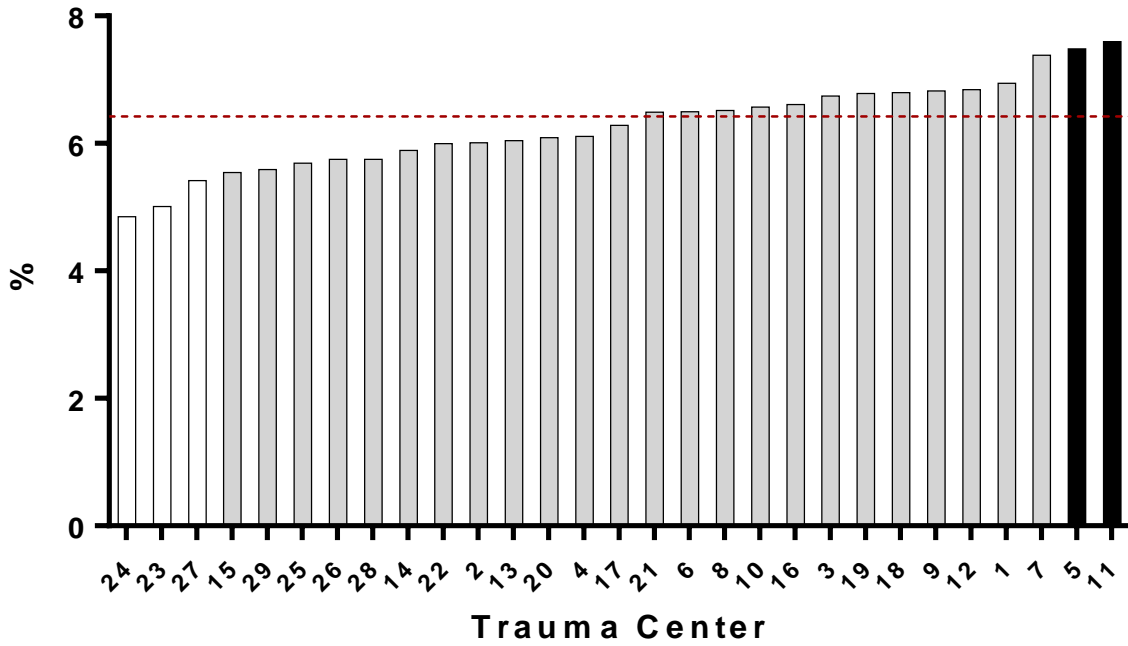
### Mortality (Penetrating w/o DOA)



### Mortality (Cohort 6)

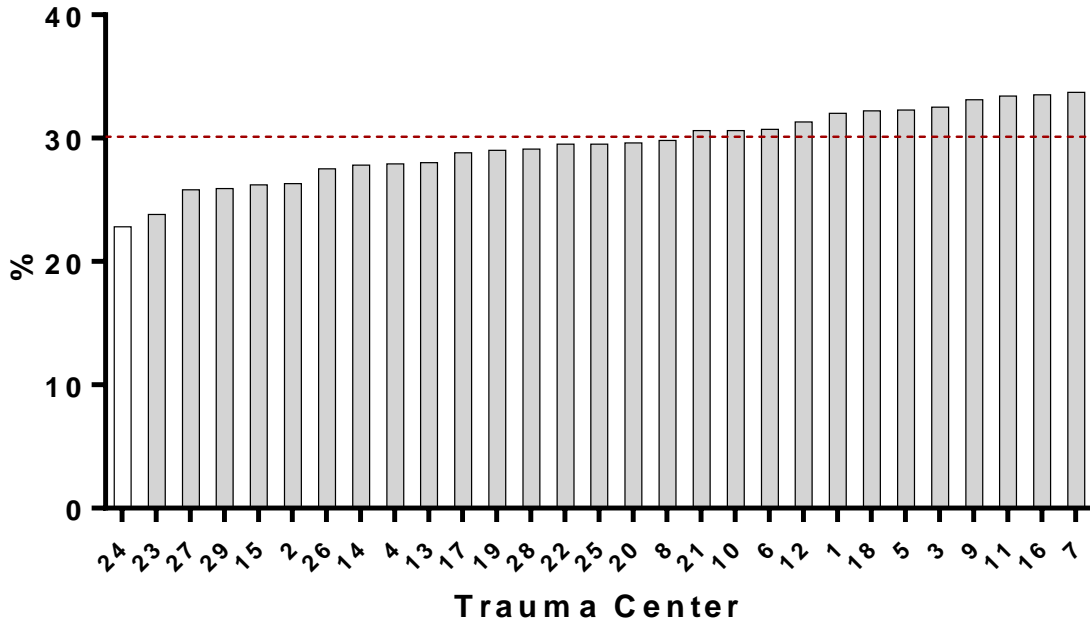


### Mortality (Cohort 7)

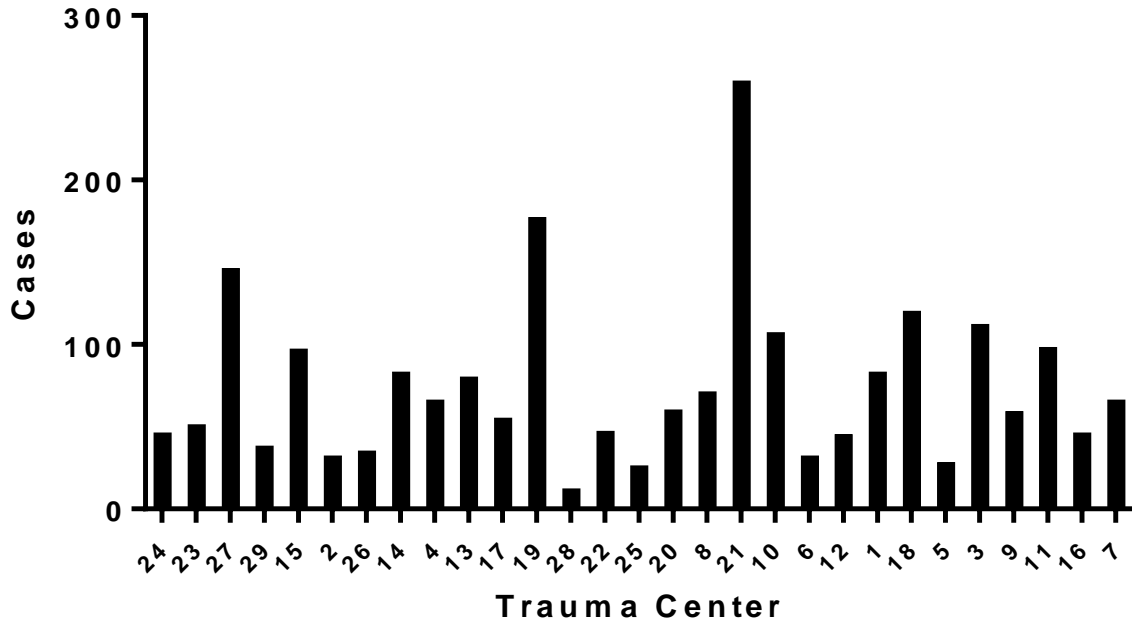




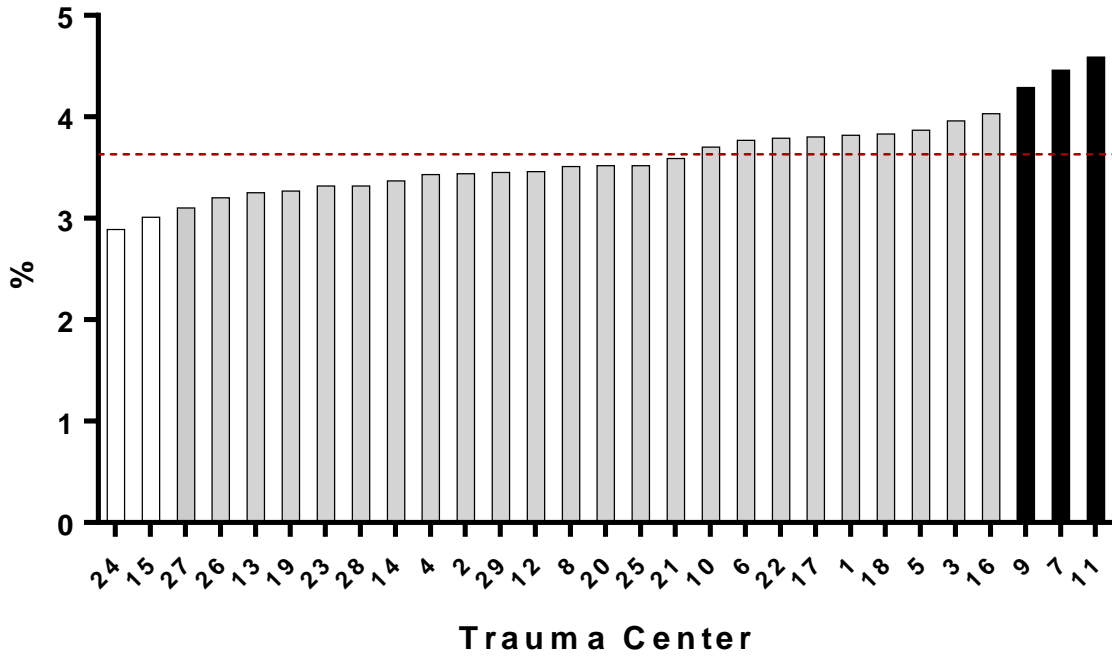
### ISS > 25 Mortality



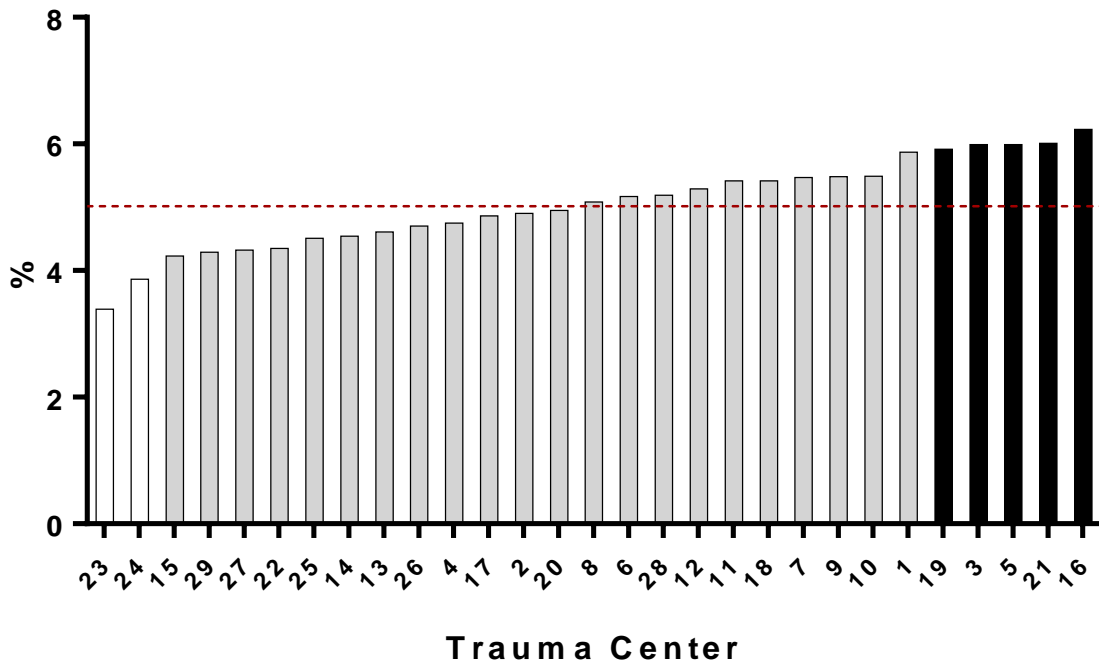
### Case Volume ISS > 25 Mortality



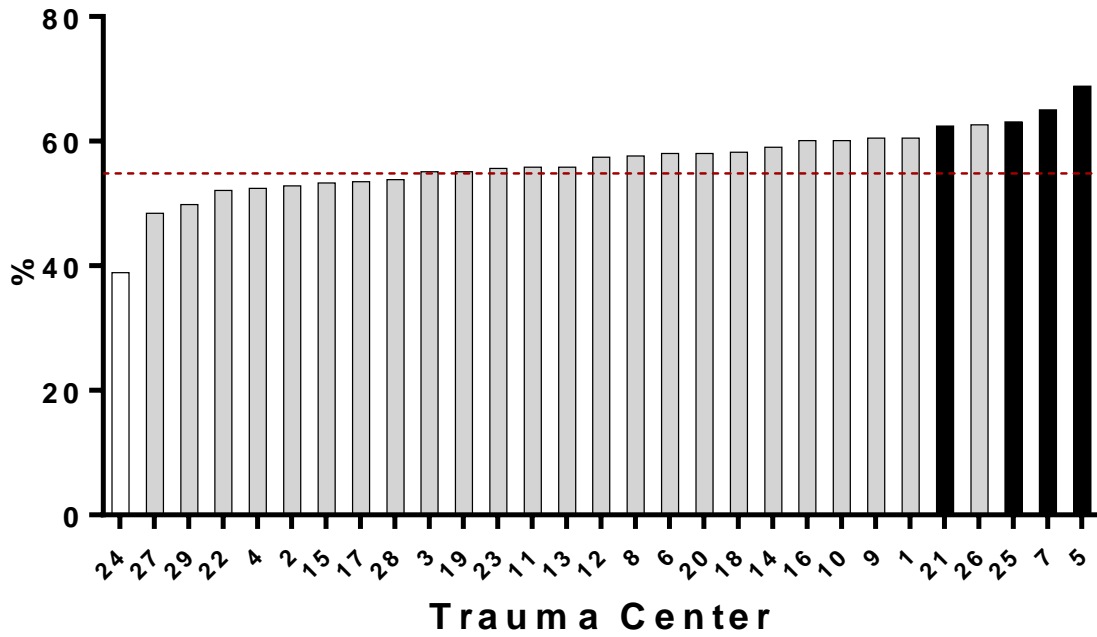
### Mortality (<65 yo)



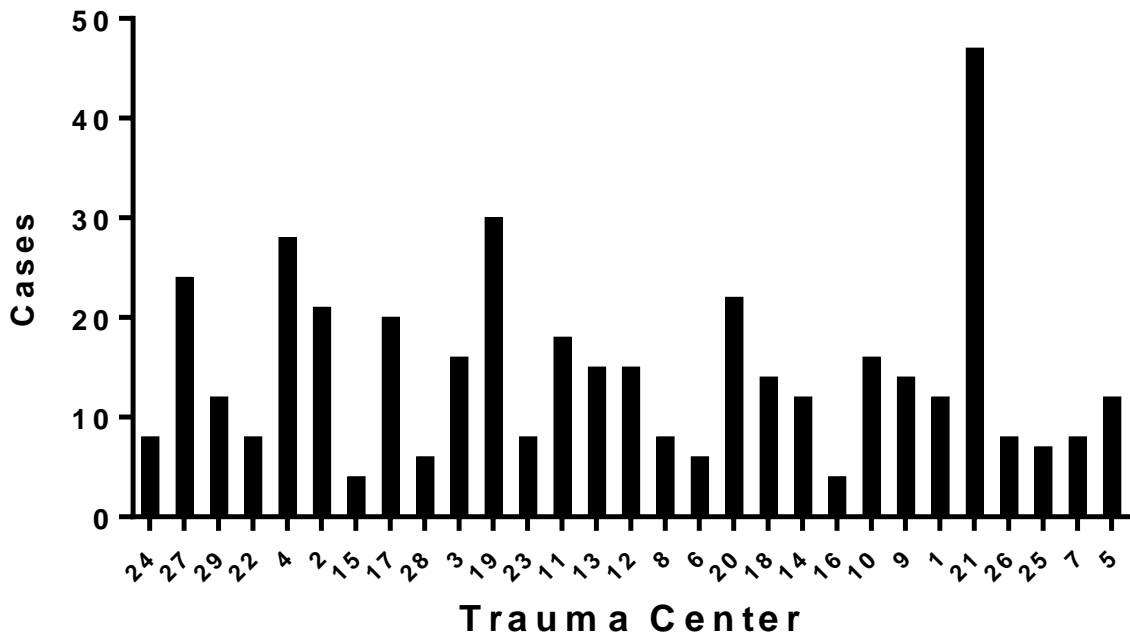
### Mortality (≥ 65 yo)



**Mortality (Cohort 1, GCS 3-8, ≥ 65 yo)**

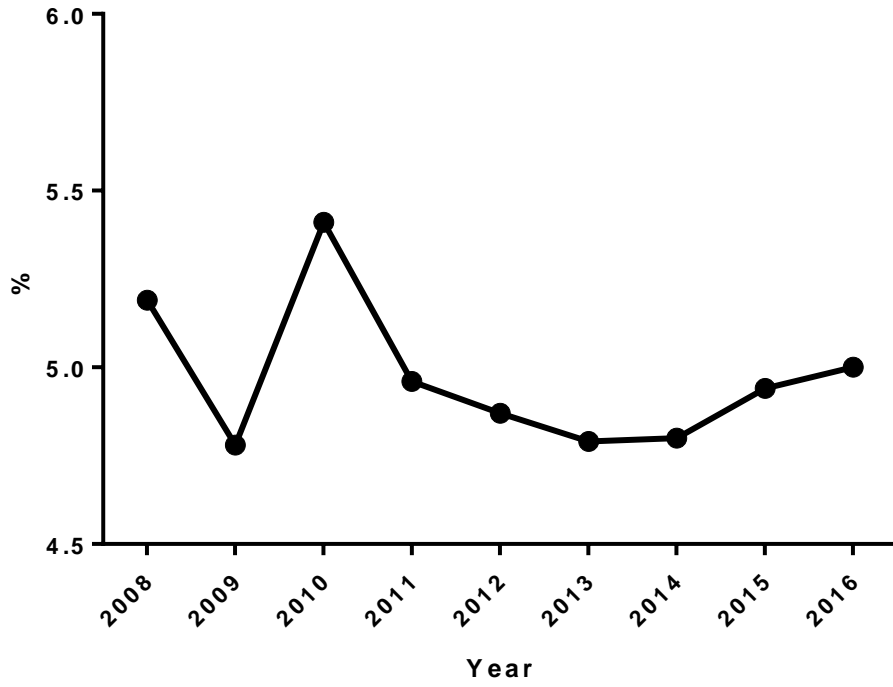


**Case Volume (Cohort 1, GCS 3-8, ≥ 65 yo)**

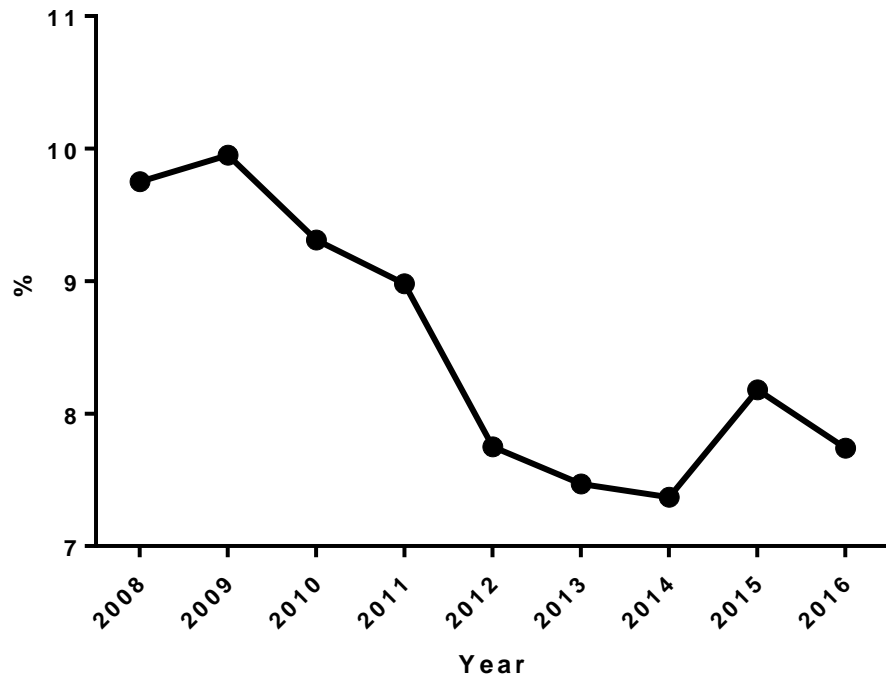


Trends

Consortium Outcome Overview - Dead

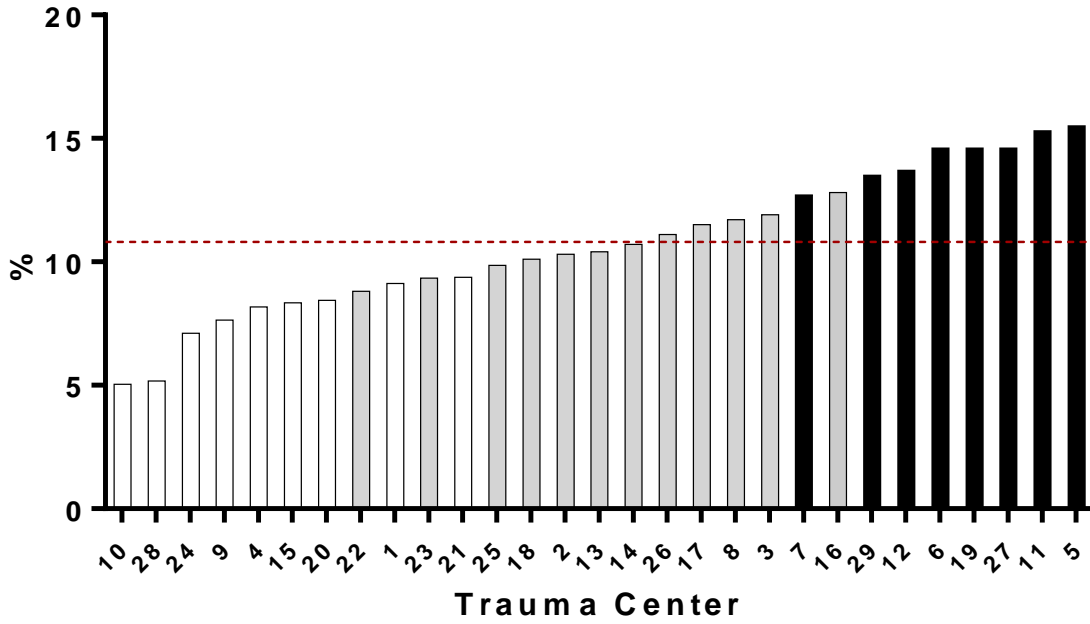


Consortium Outcomes Overview Serious Cx

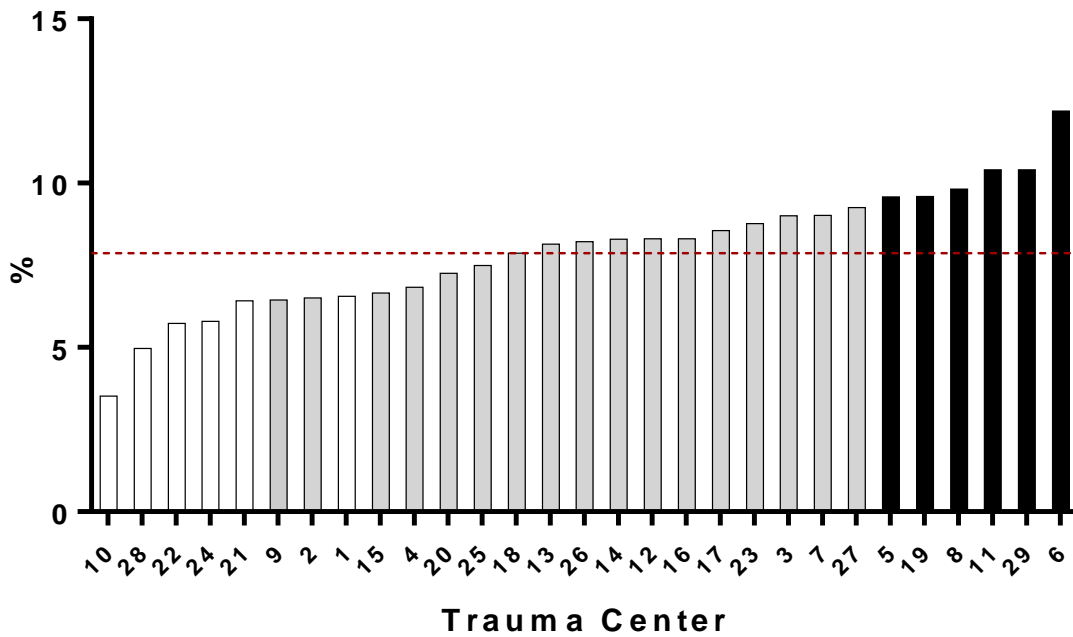


Outcomes

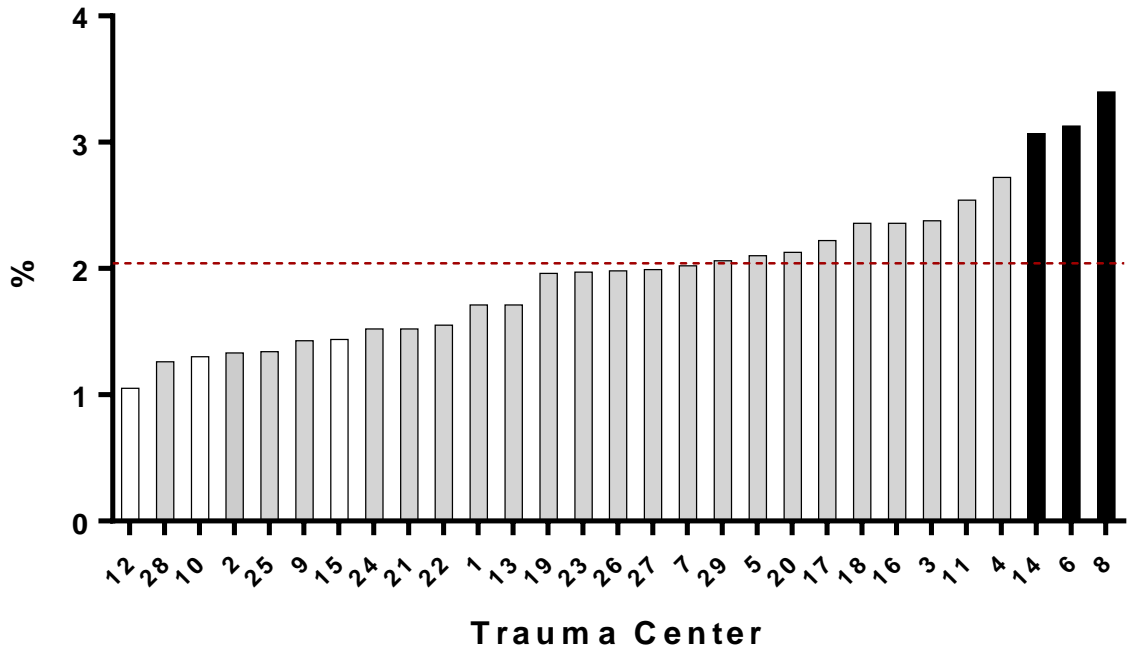
Complications (Any)



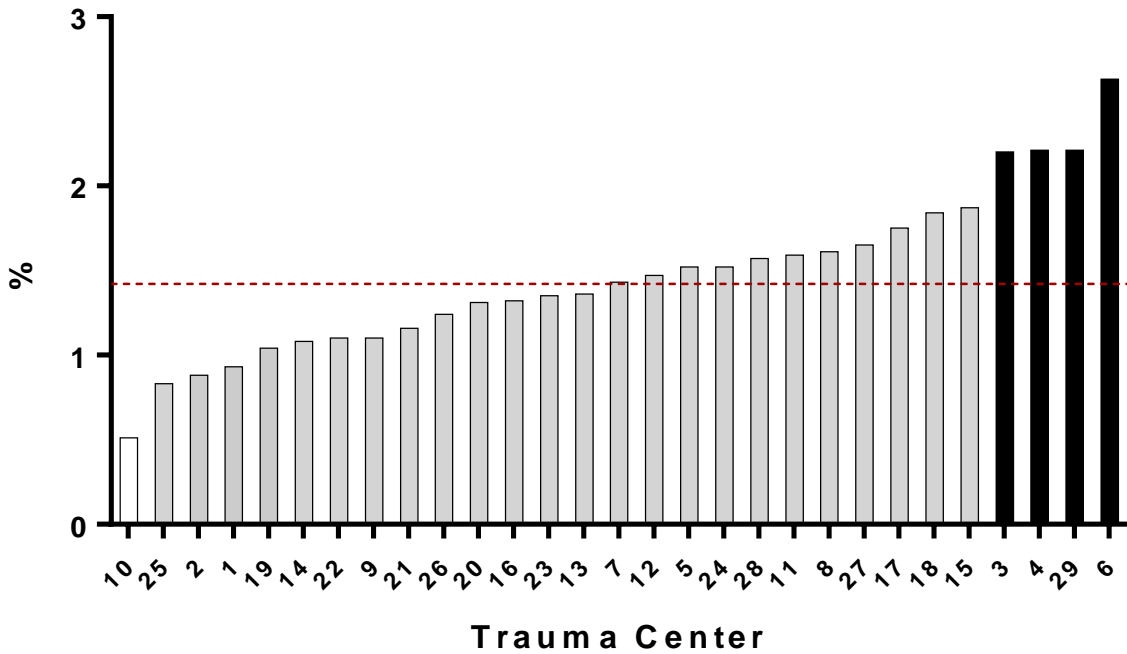
Complications (Serious)



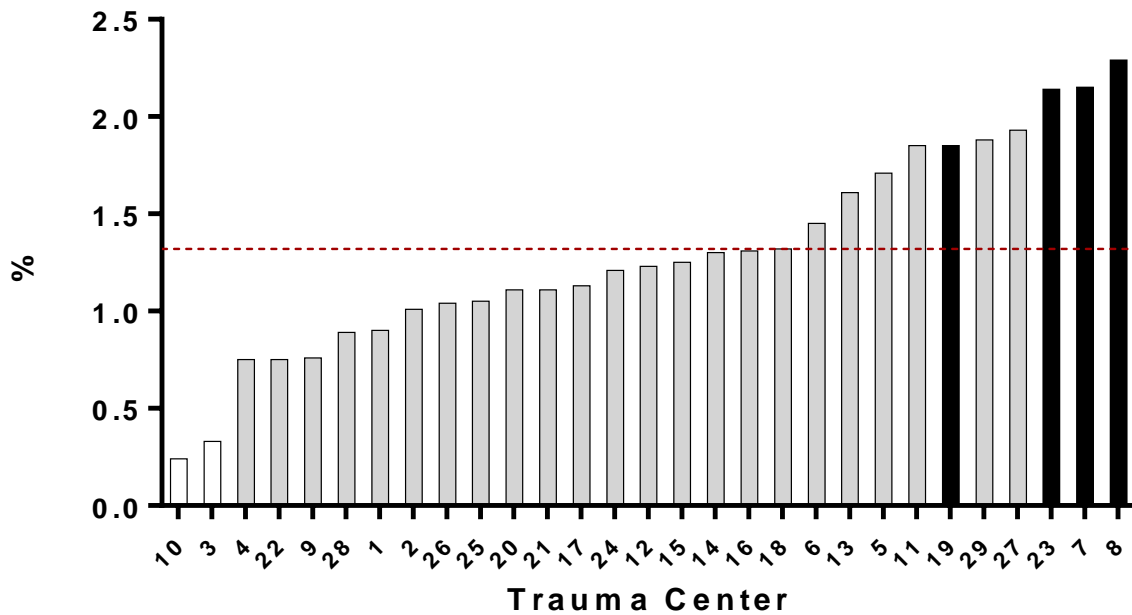
### Cardiac/Stroke



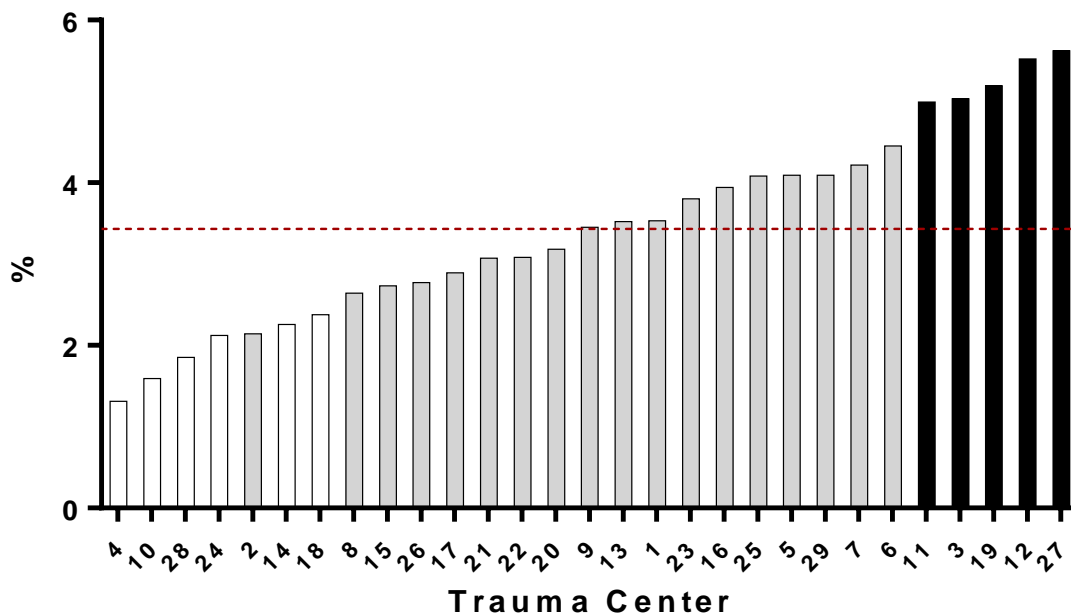
### DVT/Pulmonary Embolus



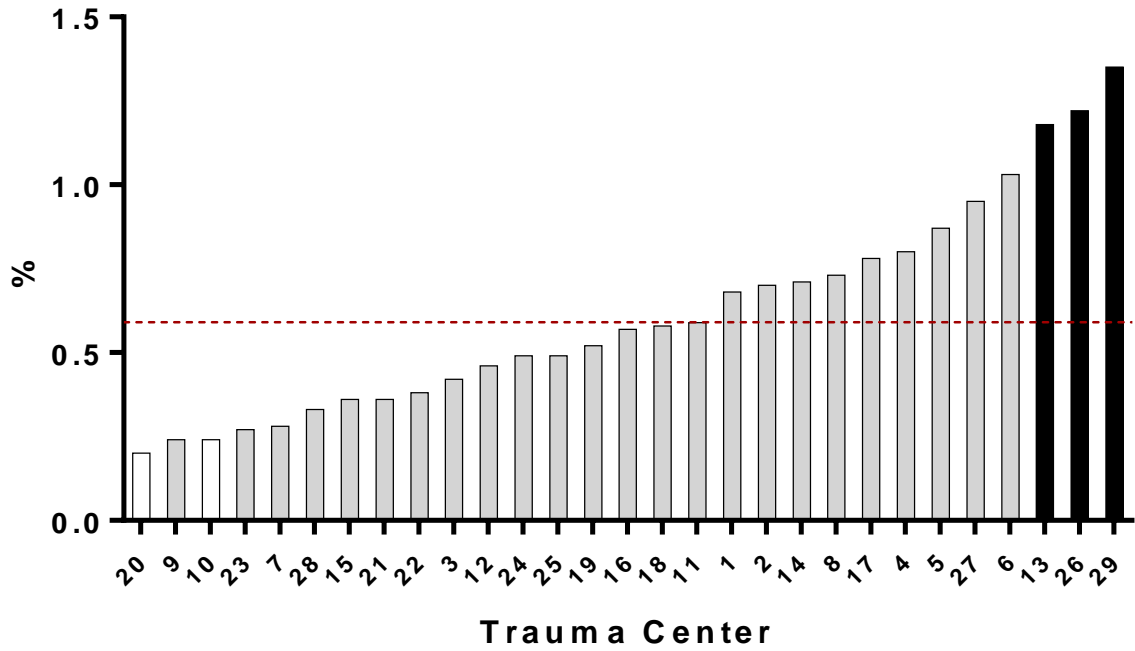
### Unplanned Intubation



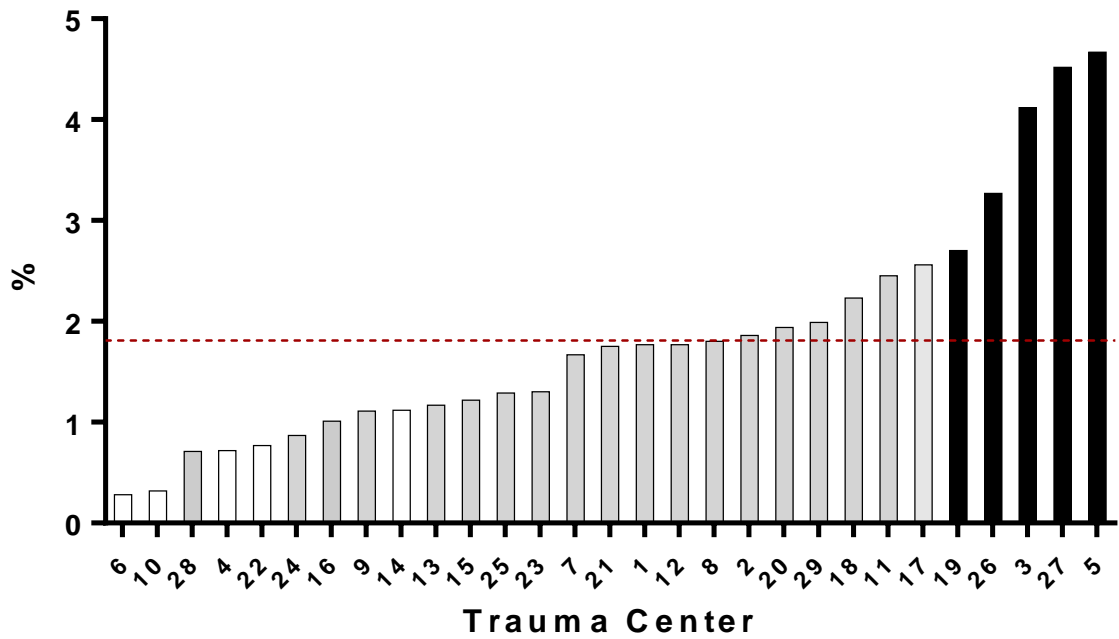
### Pneumonia



## Renal Failure

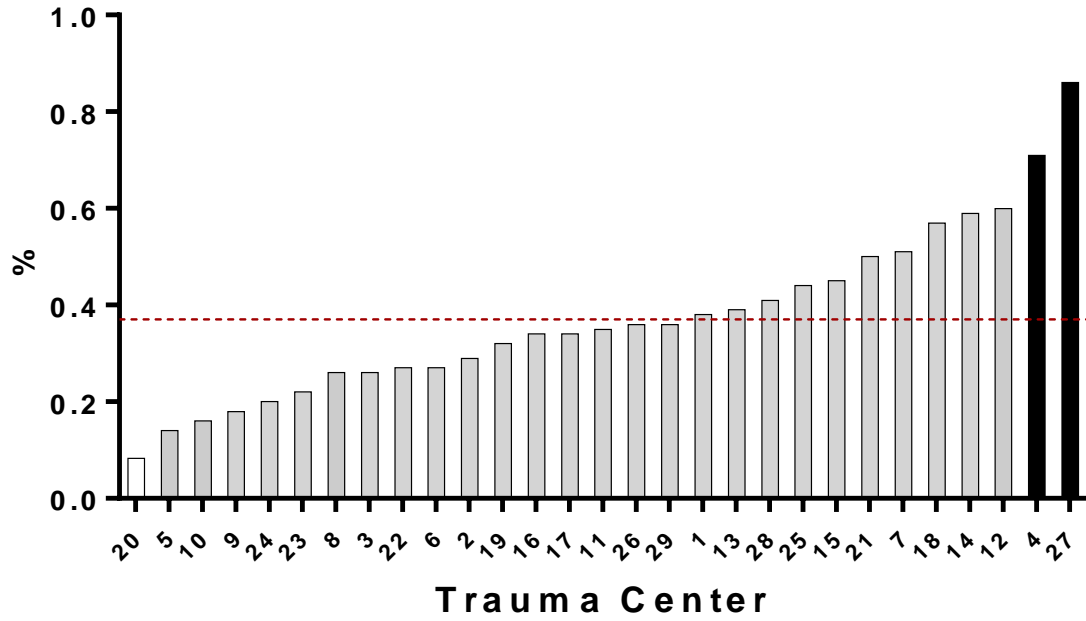


## UTI

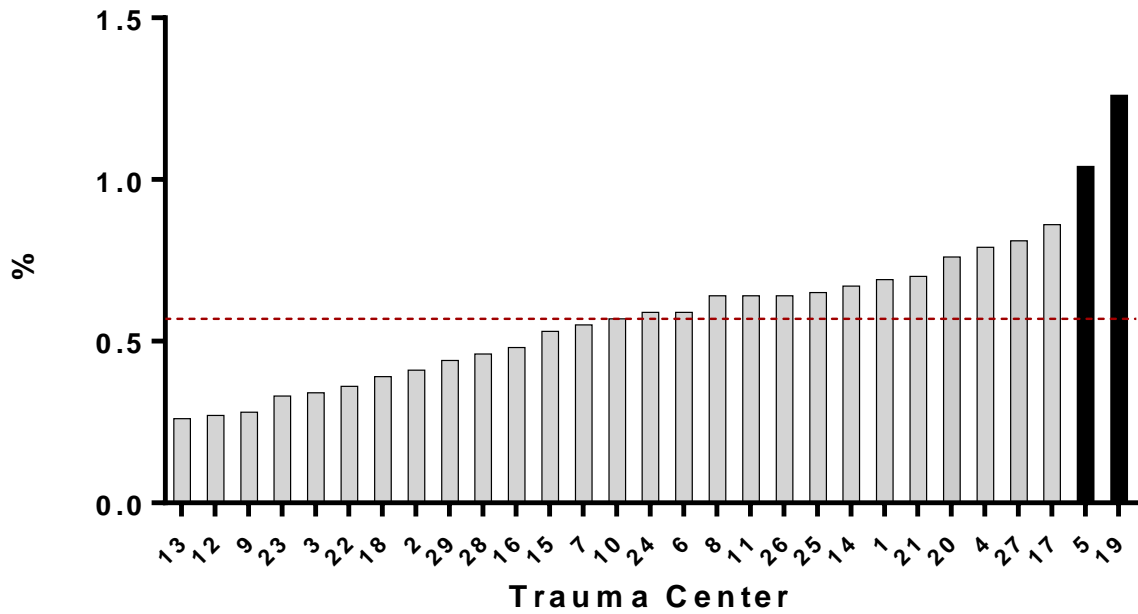




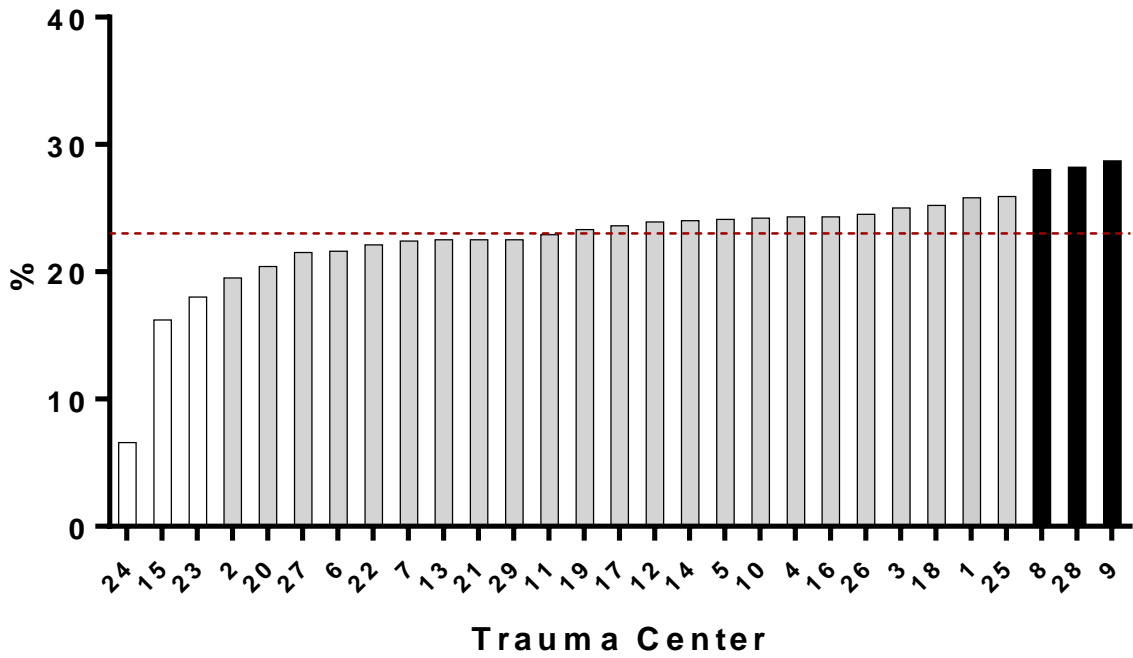
### C. Difficile Colitis



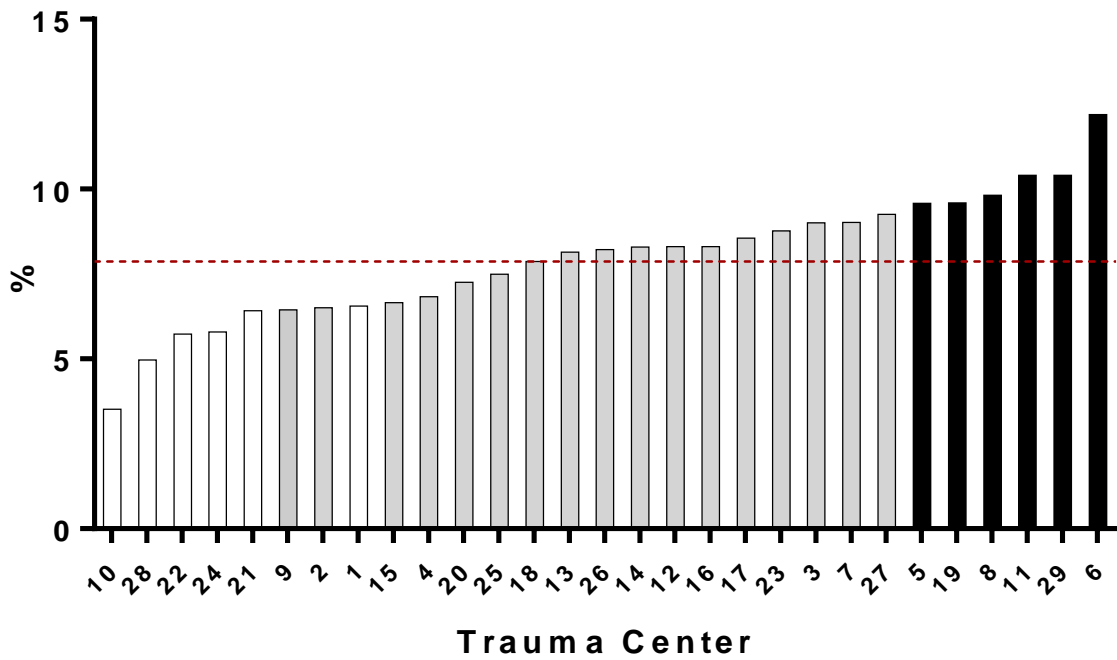
### Sepsis



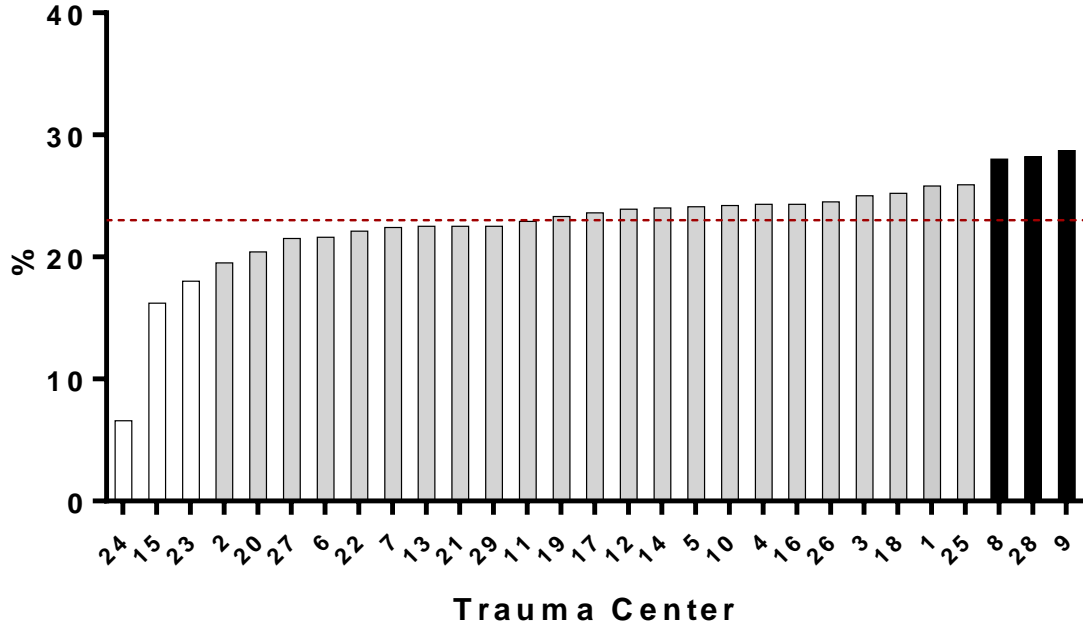
### Failure to Rescue



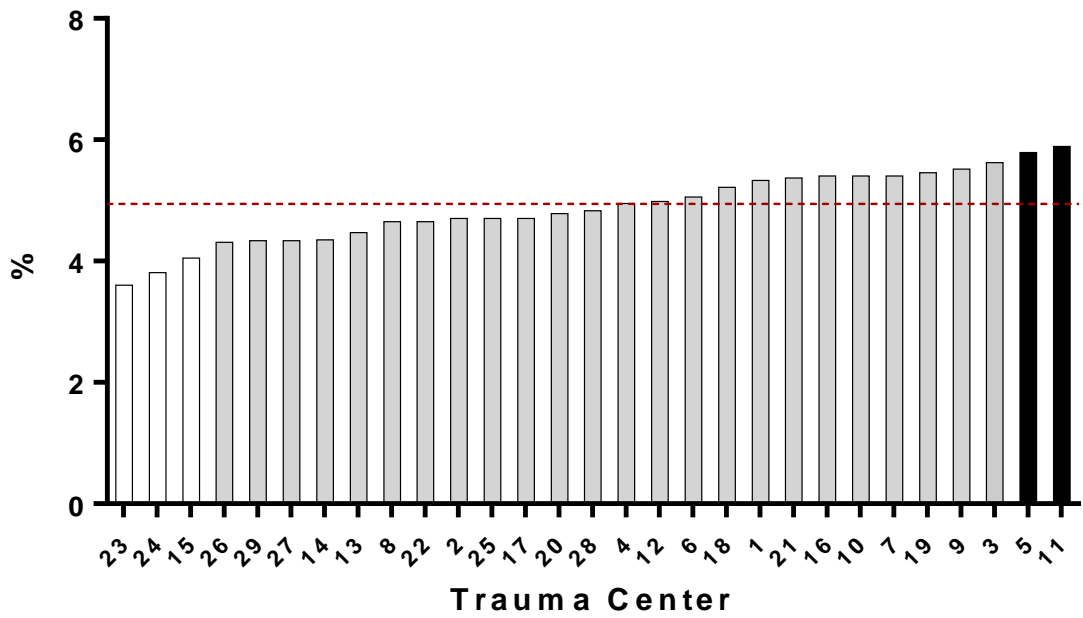
### Complications (Serious)



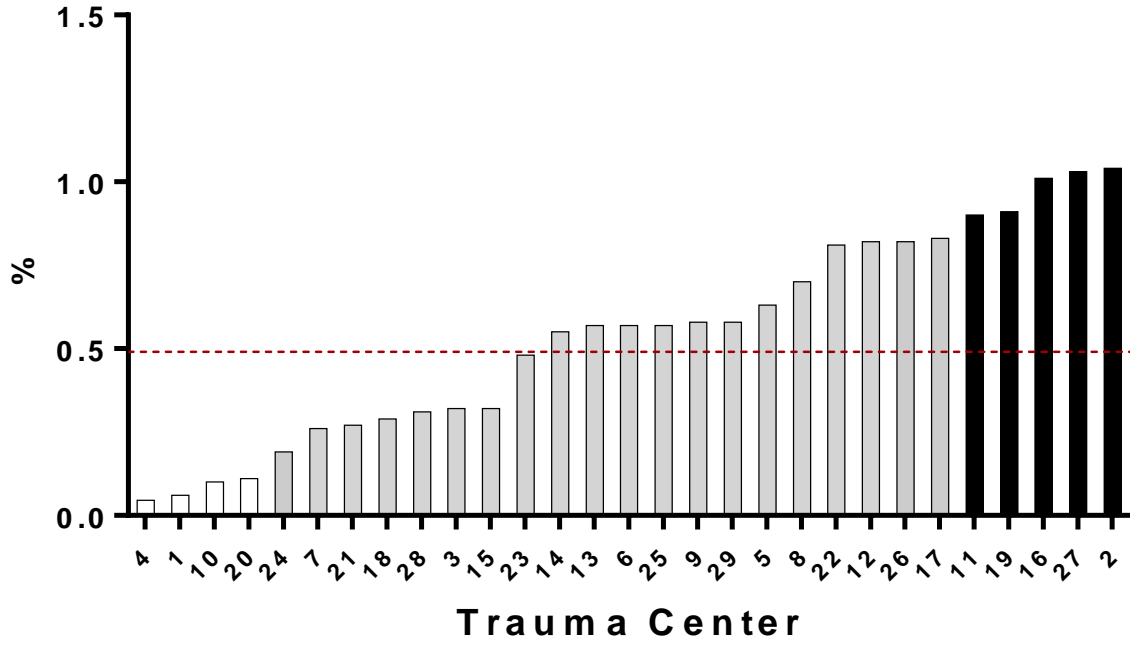
### Failure to Rescue



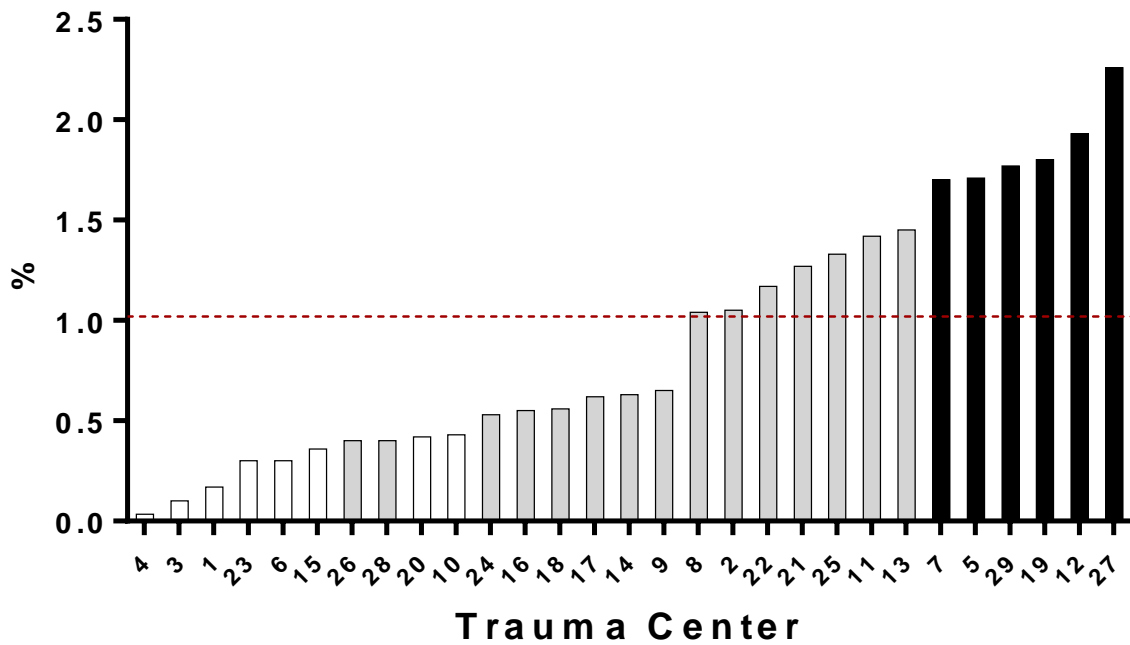
### Mortality (Cohort 2 w/o DOA's)



### Unplanned Return to OR

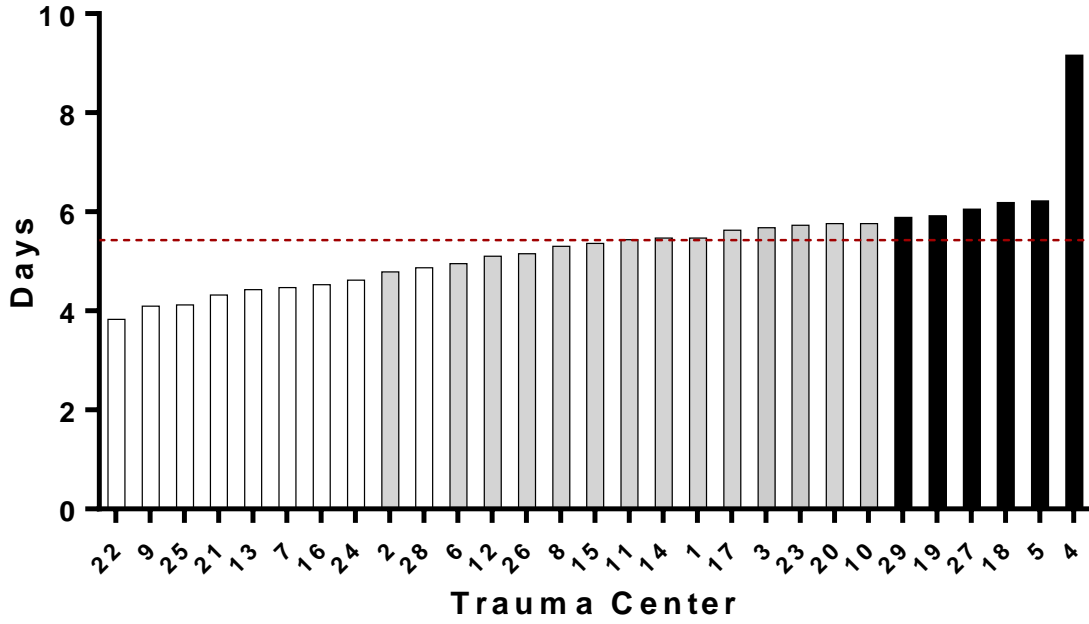


### Unplanned Admit or Return to ICU

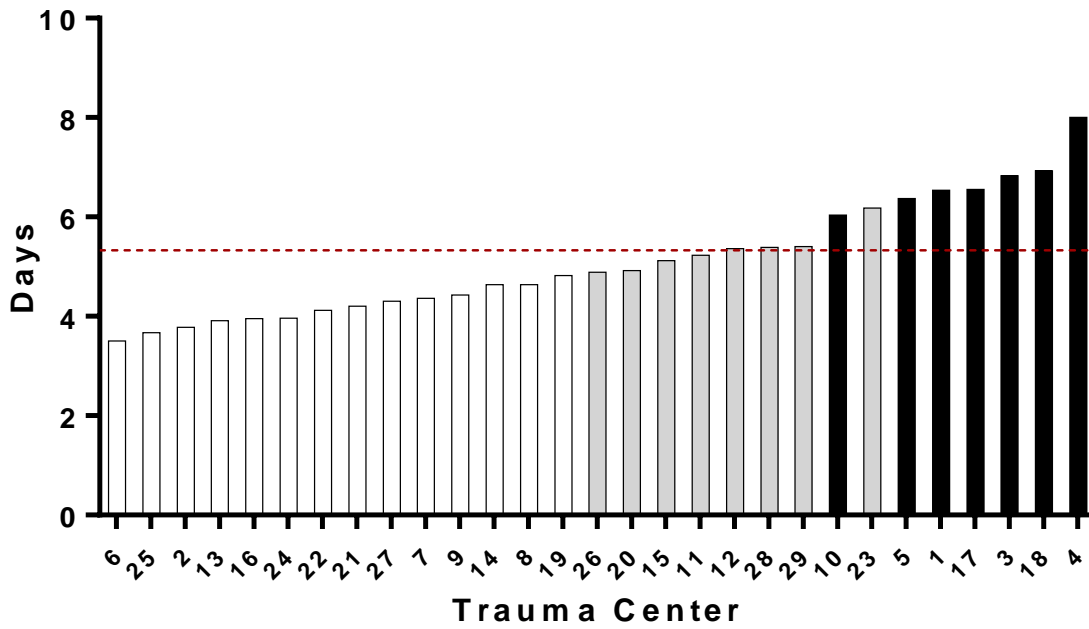


Resource Utilization

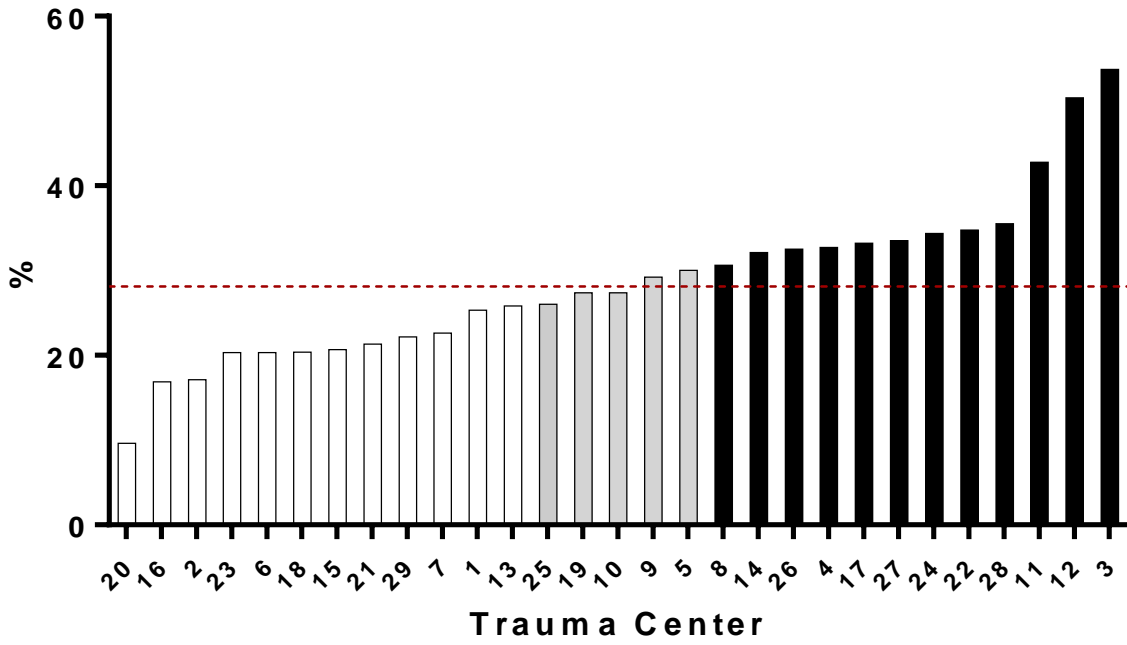
### Adjusted Hospital LOS



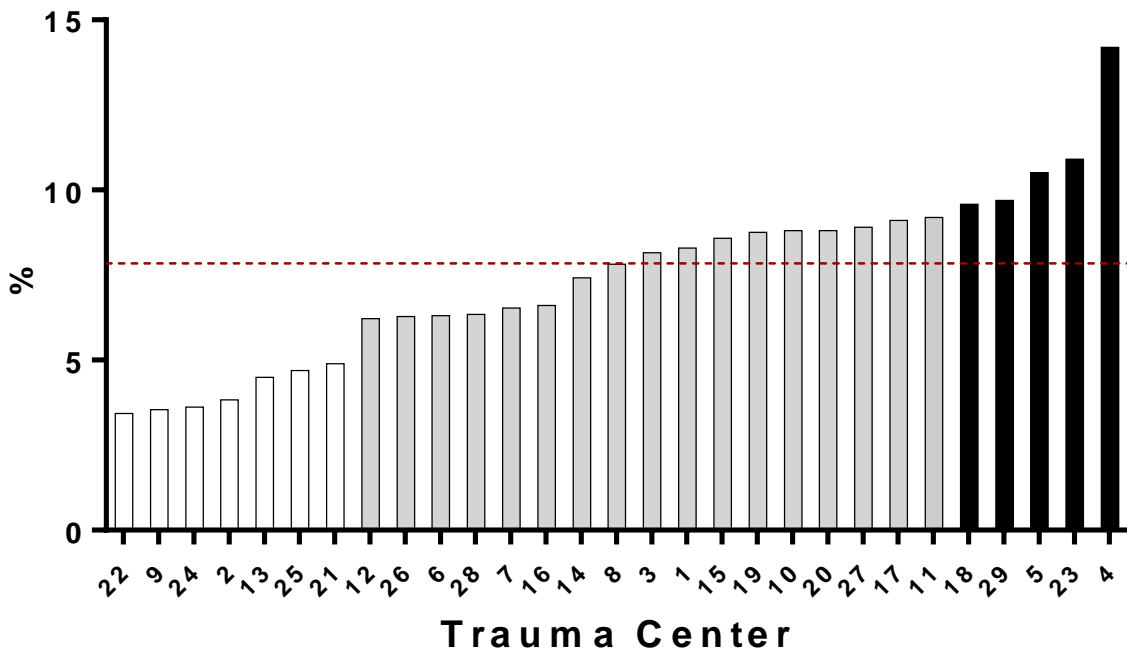
### Adjusted ICU LOS



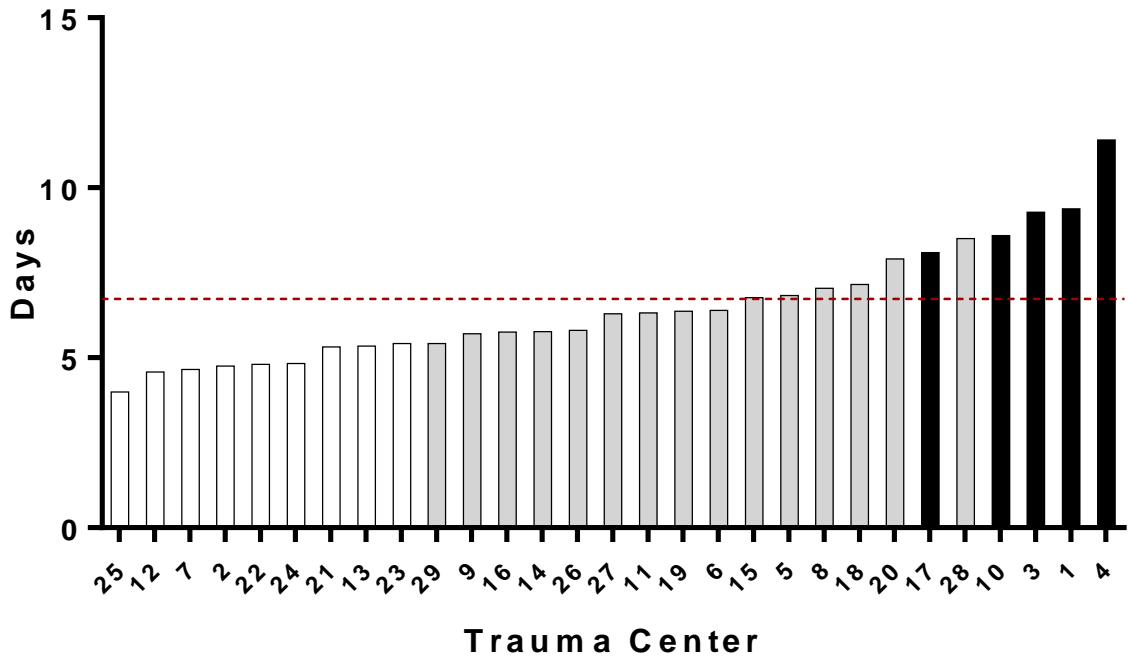
### Patients Admitted to ICU



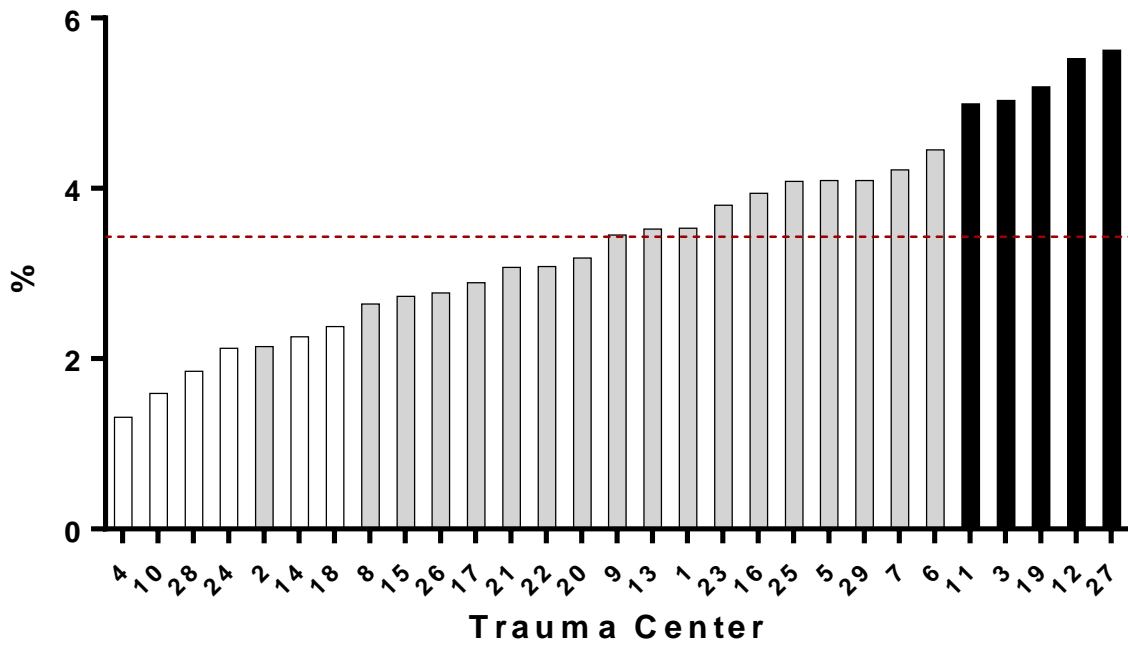
### Extended LOS



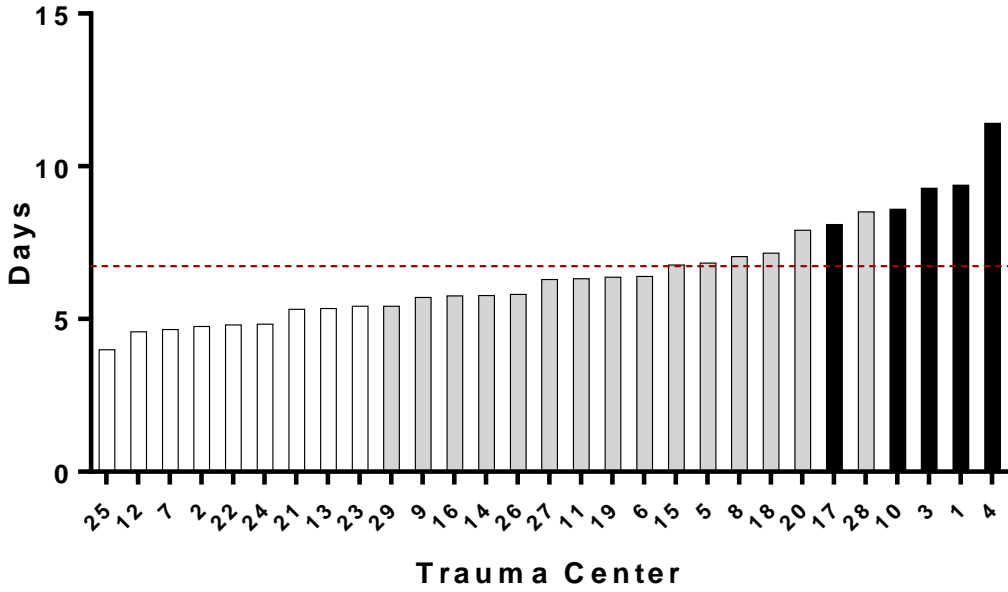
### Adjusted Ventilator Days



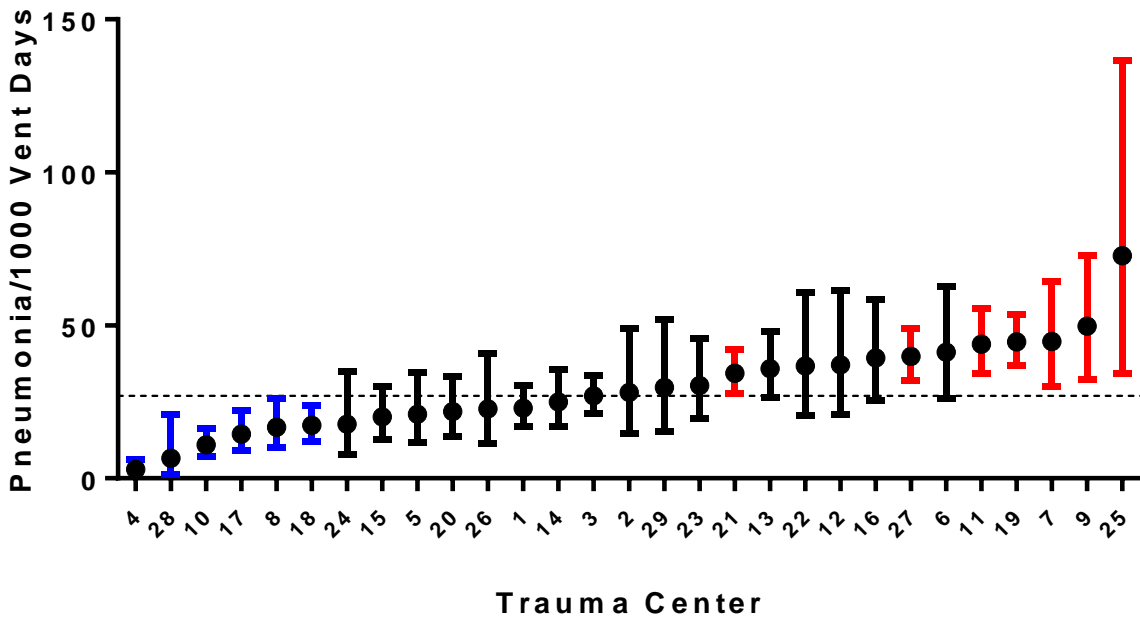
### Pneumonia



### Adjusted Ventilator Days

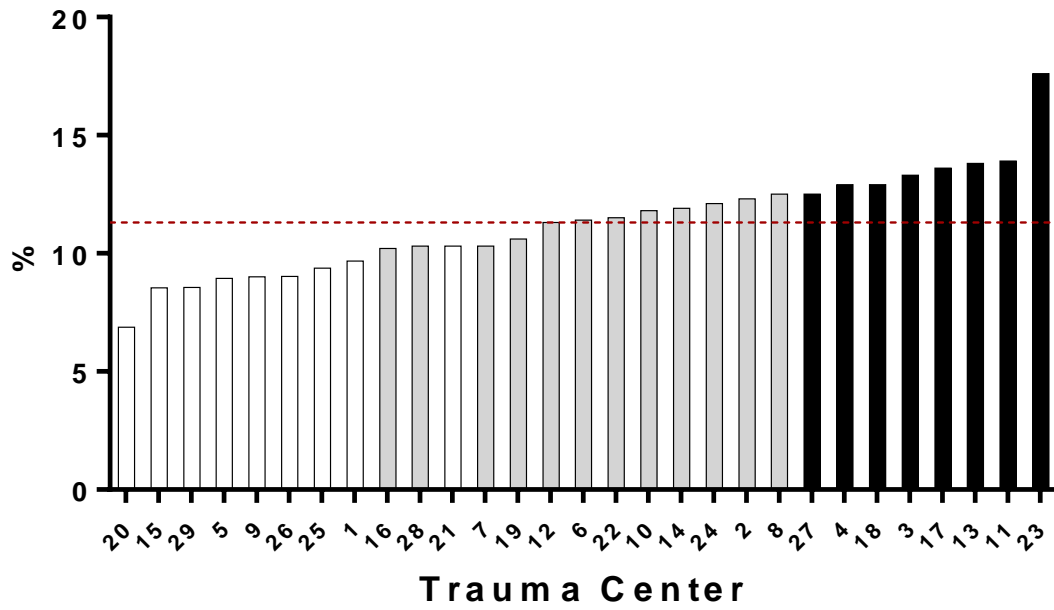


### Adjusted VAP

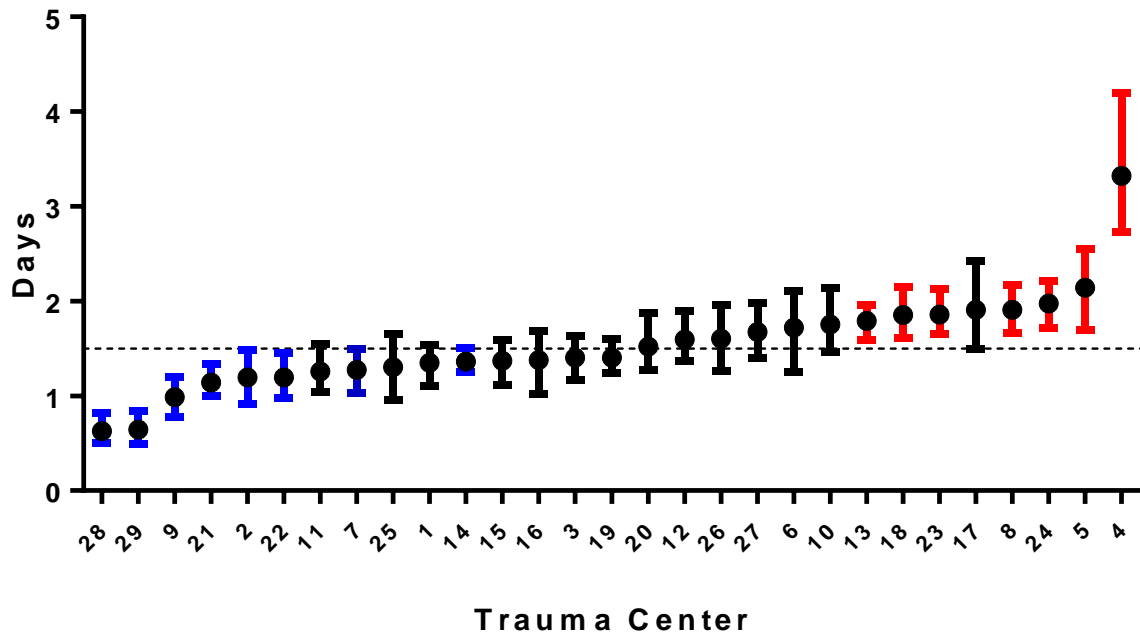




### Patients on Ventilator

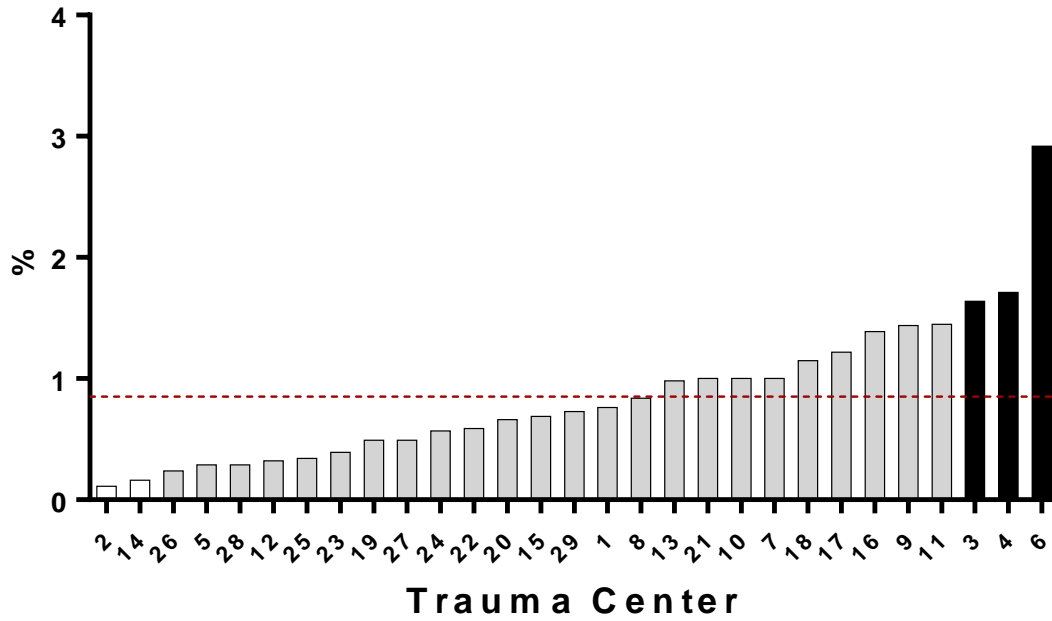


### Adjusted Antibiotic Days

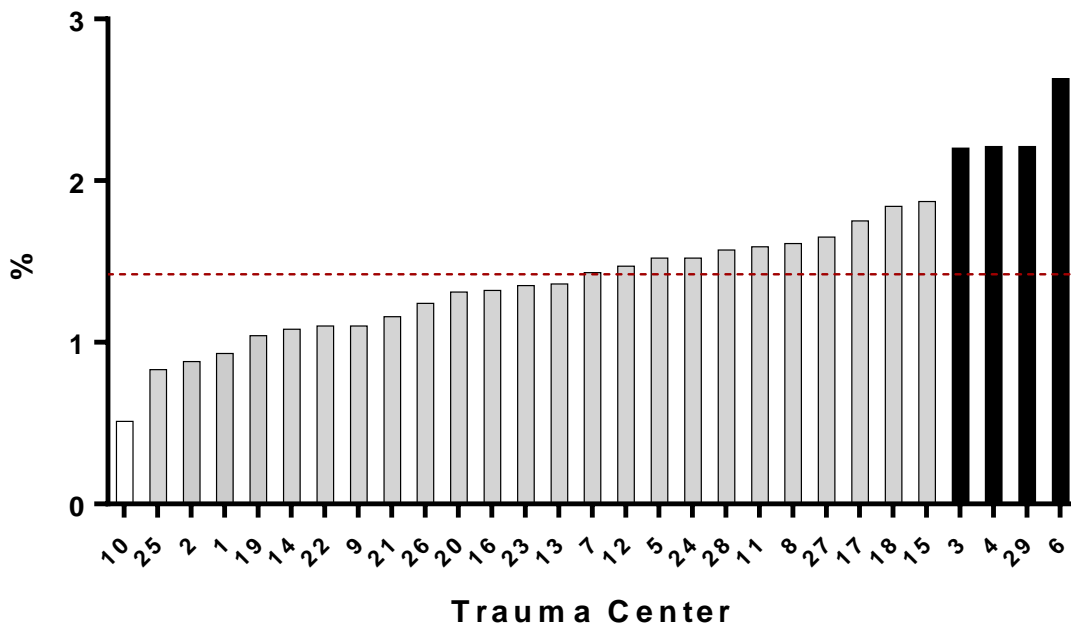


Process Measures

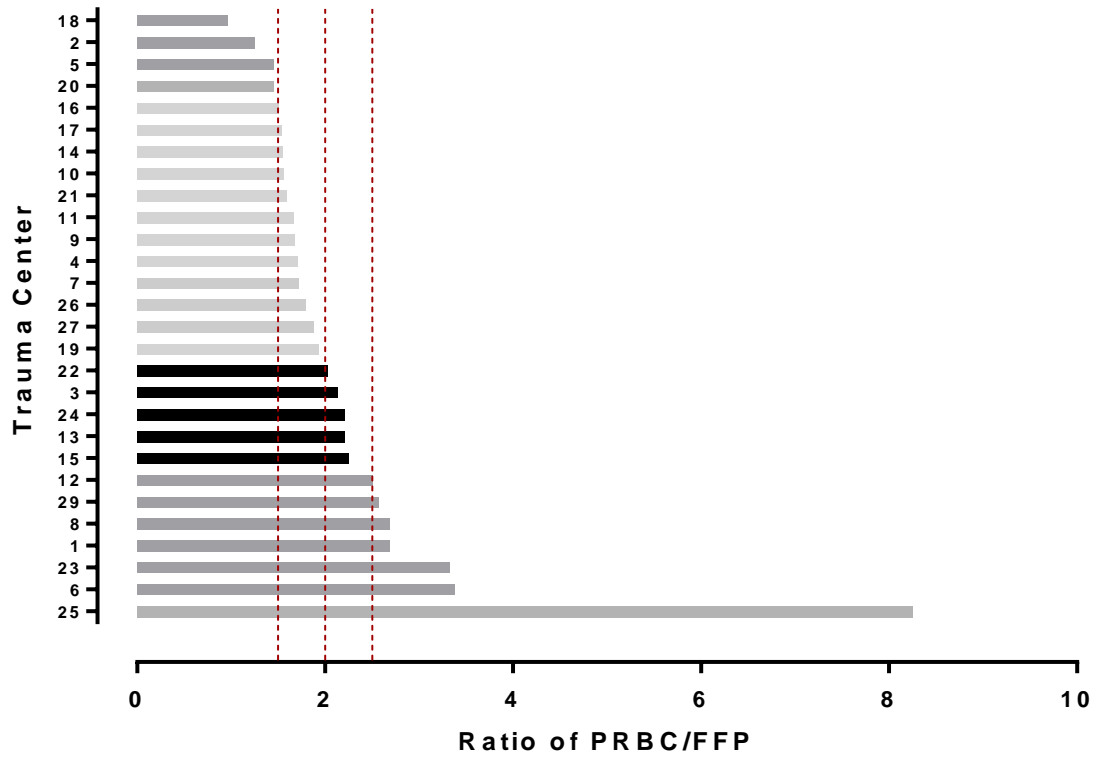
**Risk and Reliability Unadjusted IVC Filter Use**



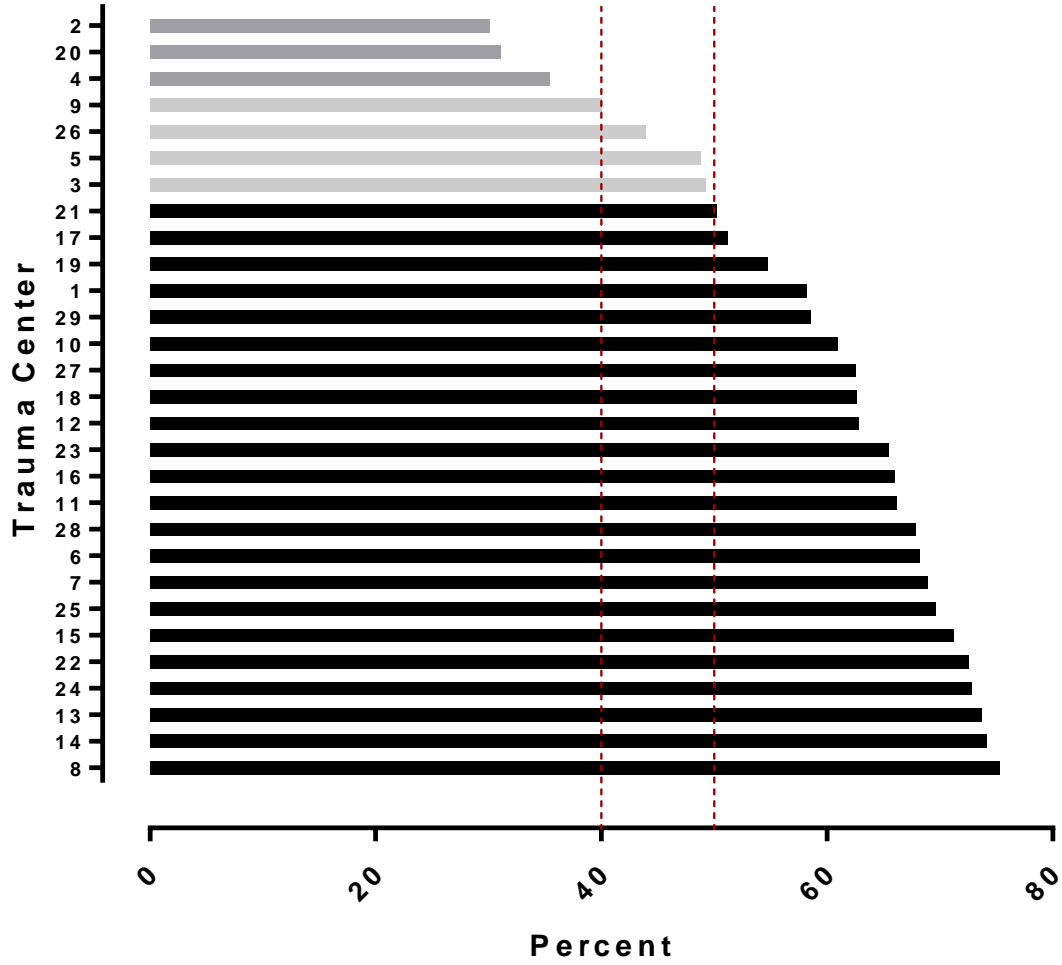
**DVT/Pulmonary Embolus**



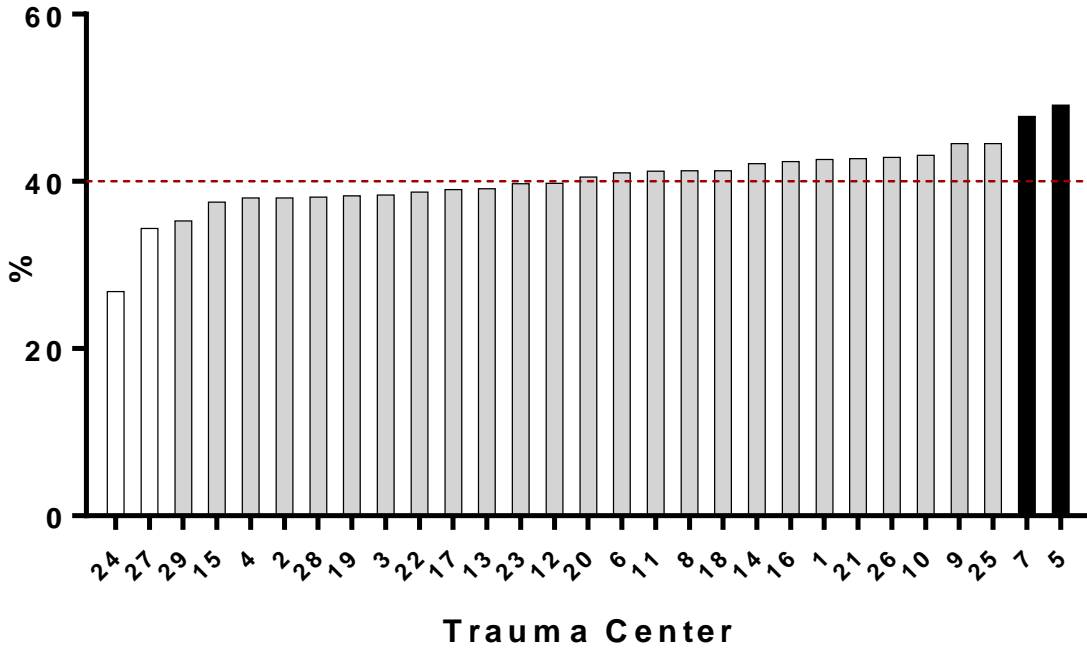
### Blood Product Ratio in first 4 hrs if $\geq 5$ uPRBCs



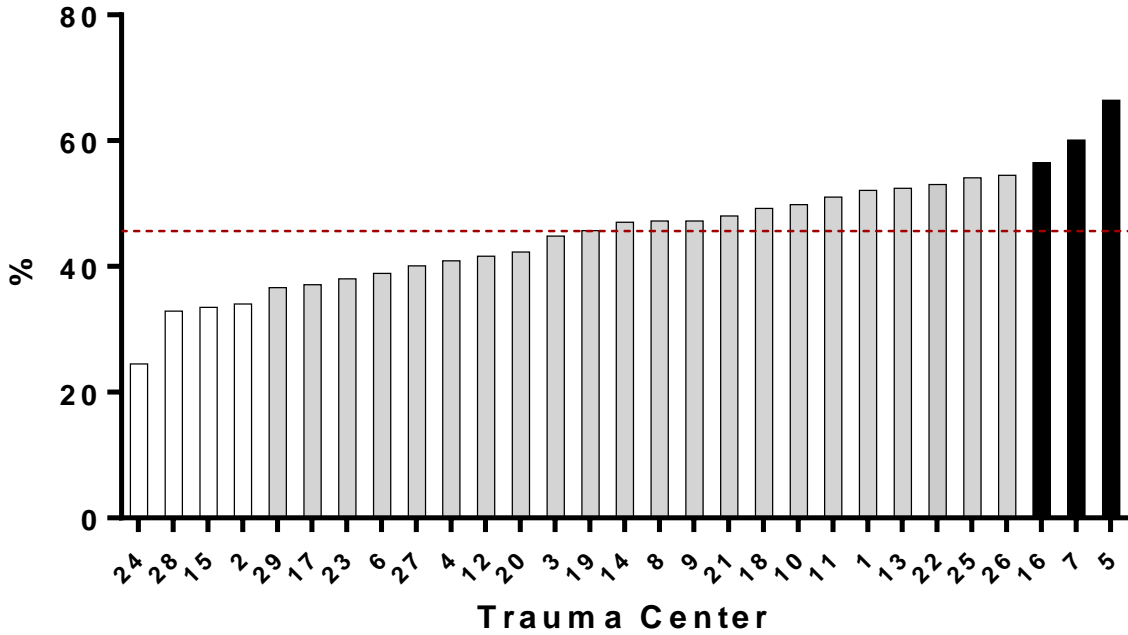
### VTE Prophylaxis by 48 hrs 1/1/16 - 9/30/16



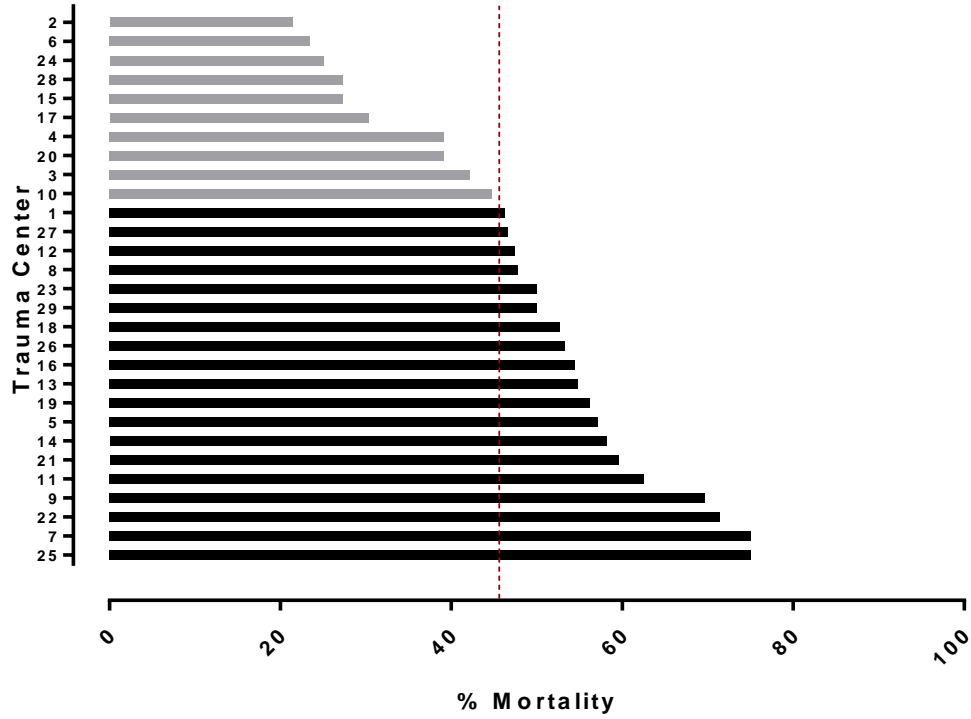
### Mortality GCS 3-8



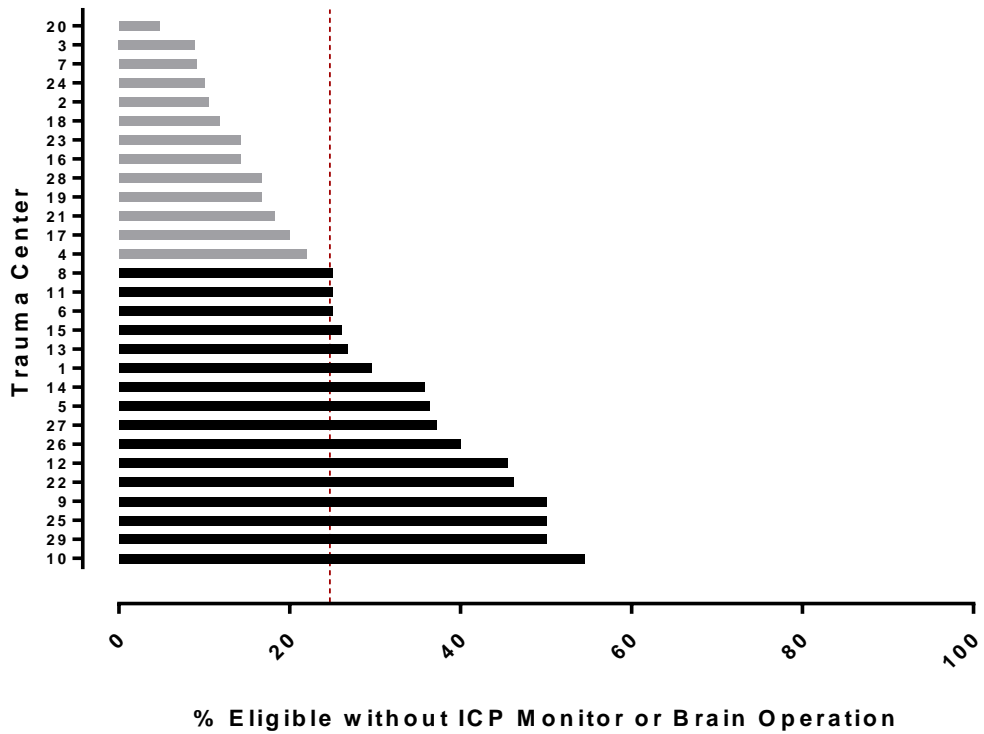
### Adjusted TBI Mortality



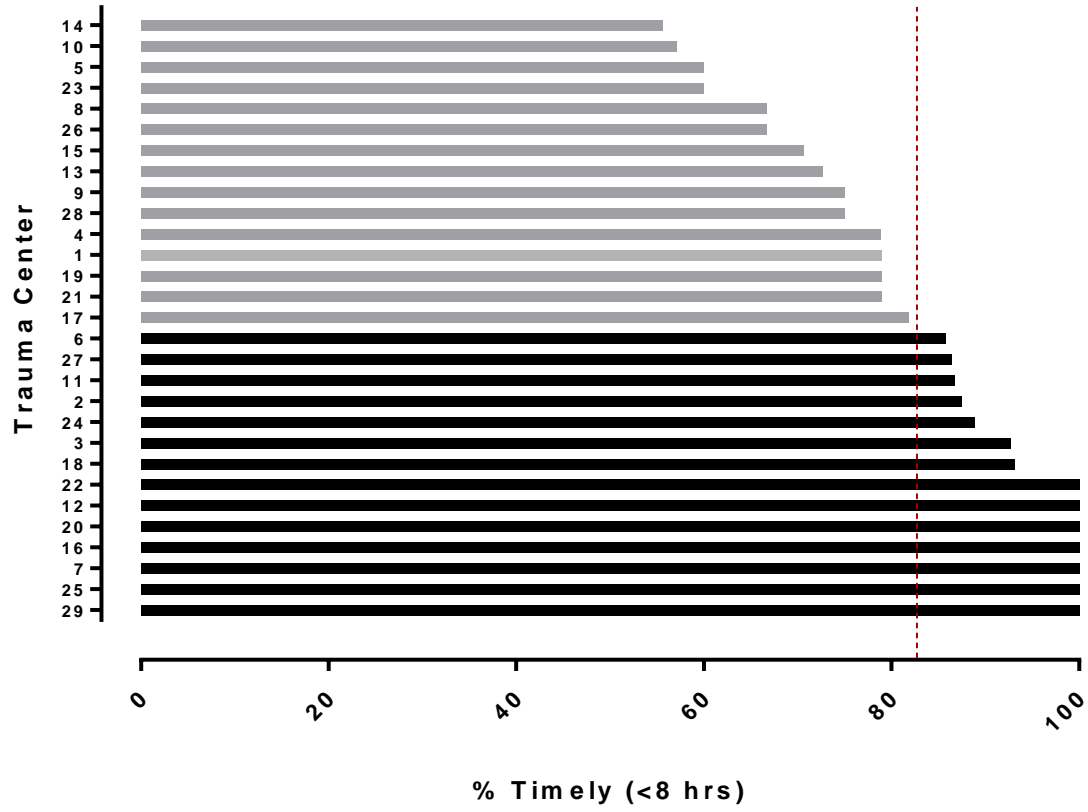
### TBI Mortality (Raw)



### TBI Intervention

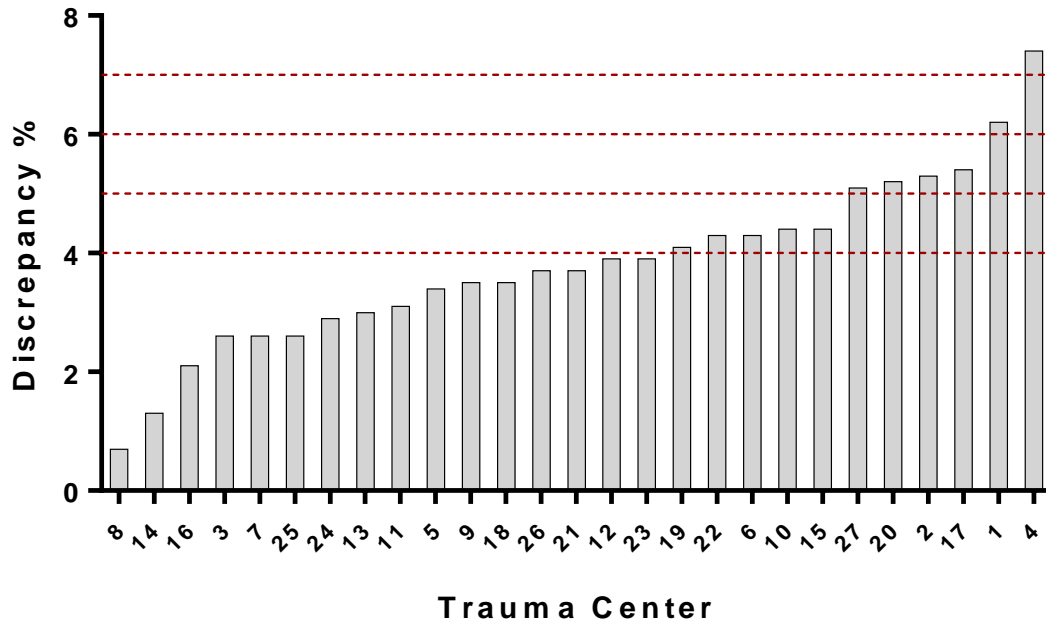


### TBI Intervention Timing



Data Validation

Validation



Total Validation Visits

