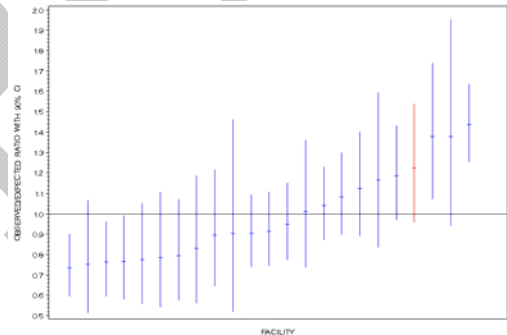


December 9, 2008

Dear TQIP Pilot Participant:

Thank you for participating in the pilot study of the Trauma Quality Improvement Program (TQIP) of the American College of Surgeons - Committee on Trauma (COT). We have enclosed a report that presents your trauma center's risk-adjusted mortality along with the other 22 participating centers based upon data with hospital arrival year of 2007. The ratio of observed number of deaths to the expected number of deaths (O/E ratio) is used for this analysis. The expected number of deaths was derived from a statistical model that allows us to estimate the number of deaths based upon the characteristics of the patients at your institution. We report the O/E ratio along with the 90% confidence intervals (CI). A 90% CI indicates that we are 90% certain that the true O/E ratio falls within this range. The inclusion criteria, statistical methodology, a guide to the interpretation of findings, and limitations of this analysis are described in detail in the attached document.

In summary, the observed-to-expected mortality ratio of data qualifying into TQIP with admission year 2007 at your trauma center was equal to 1.0 as depicted by the red bar in the diagram. This suggests that the number of deaths at your trauma center were the same as expected from their baseline characteristics and injury severity.



Thanks again for your participation in TQIP. Please feel free to contact us with any concerns or questions.

Trauma Quality Improvement Program (TQIP), ACS Committee on Trauma

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*2008 TQIP Pilot Study  
Benchmark Report*

**Trauma Quality Improvement Program (TQIP)  
ACS Committee on Trauma  
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## **Background**

The American College of Surgeons – Committee on Trauma (COT) has been dedicated to improving the quality of care provided to the injured patient for over eight decades. In October 2006, the COT established a work group and charged it to “design and test a Trauma Quality Improvement Program (TQIP) that is validated, risk-adjusted and outcomes based, to measure and improve the quality of trauma care.” TQIP supports the College’s mission of promoting the highest standards of surgical care through the evaluation of risk-adjusted surgical outcomes in clinical practice, and is committed to improve the quality of trauma care. To accomplish this, the TQIP work group has developed a process to collect valid and reliable data, measure risk-adjusted outcomes, and provide feedback to participating trauma centers. Our future plans are to identify practices in high performing centers and assist in the dissemination of the practices to elevate the quality of care at all centers.

The TQIP pilot began in June 2008. Your facility volunteered and was chosen to participate in the TQIP pilot. Registrars and data abstractors from participating centers were trained in June 2008 with follow-up training through webinars and conference calls. Data from the pilot centers were collected during the regular 2008 NTDB call for data and thus pertain to admissions between January 1 and December 31, 2007. Hence, this report is based on registry data entered prior to TQIP training or introduction of the National Trauma Data Standard (NTDS).

### **NTDB Confidentiality Policy**

Use of NTDB data is in strict compliance with the Health Insurance Portability and Accountability Act of 1996 (HIPAA). The NTDB does not distribute or report hospital information in any manner that allows the reporting hospital to be identified without the express written permission of the hospital. The information identifying your trauma center in this report is reported only to you.

### **Participating Hospitals**

Institutional criteria for participation in TQIP require ACS or state Level I or II verification or designation. This pilot study includes 23 Level I or II trauma centers, which were selected based on their interest in TQIP and their commitment to NTDB. Appendix 2 shows a list of participating hospitals.

### **TQIP Patient Population**

Selected trauma incidents submitted to NTDB were included in this report. This more focused population facilitates inter-facility comparisons. The inclusion and exclusion criteria for patients included in the TQIP analyses are described in detail in this section.

## ***Inclusion and Exclusion Criteria***

### **Inclusion Criteria:** (must meet all of the following criteria)

- Age  $\geq$  16 years
- At least one valid trauma ICD-9 code in the range of 800–959.9 (excluding late effects (905-909.9), superficial injuries (910-924.9), and foreign bodies (930-930.9)).
- Primary mechanism of injury classified as either blunt or penetrating:
  - Blunt is defined as an injury where the primary E-code is mapped to the following categories: fall, machinery, motor vehicle traffic, pedestrian, cyclist, and struck by or against
  - Penetrating is defined as an injury where the primary E-code is mapped to the following categories: cut/pierce and firearm
- Severely injured patients with at least one AIS  $\geq$  3:
  - For blunt injuries: At least one injury in any of the following AIS body regions: head, face, neck, thorax, abdomen, spine, or upper and lower extremity.
  - For penetrating injuries: At least one AIS  $\geq$  3 injury in any of the following AIS body regions: neck, thorax, and abdomen.
- Calculated injury severity score (ISS)\*  $\geq$  9
- ED discharge disposition and hospital discharge disposition must be known.

### **Exclusion Criteria:**

- GSW to the brain defined by: Any E-codes: E922.0-.9 E955.0-.4 E965.0-4, E979.4 E985.0-.4 E970 AND at least one ICD-9 code in the range: 800 - 801.99, 850-854.1
- Comorbidity: Pre-existing advanced DNR directive to withhold life sustaining interventions
- Dead on arrival

\* Injury severity score (ISS) was calculated by NTDB using ICDMAP. See *Methodology* for further information.

## **Patient Cohorts**

TQIP reports on all incidents that meet the inclusion criteria specified above and on three distinct cohorts of severely injured patients derived from this population. These three cohorts were selected to reflect the wide spectrum of trauma patients and their distinct challenges. It also provides an opportunity for centers with significant over-representation of a particular type of patient to better understand their performance relative to their peers. The cohorts are as follows:

Cohort 1- Blunt multisystem injury: Trauma type classified as blunt with injuries of AIS  $\geq 3$  in at least two of the following AIS body regions: head, face, neck, thorax, abdomen, spine, and upper and lower extremities.

Cohort 2 – Penetrating truncal injury: Trauma type classified as penetrating with injuries of AIS  $\geq 3$  in at least one of the following AIS body regions: neck, chest, or abdomen.

Cohort 3 – Blunt single system injury: Trauma type classified as blunt with injuries of AIS  $\geq 3$  limited to only one AIS body region with all other body regions having a maximum AIS  $\leq 2$ .

The selection of the blunt multisystem trauma cohort allows for the assessment of many processes and outcomes related to inter-disciplinary management including critical care, neurosurgery, and orthopedic surgery. By contrast, the penetrating trauma cohort allows for evaluation of processes and outcomes related to clinical judgment, timely operative management, and general surgical technical skills. The blunt single system injuries cohort comprises the majority of cases at trauma centers and allows for evaluation of outcomes in a cohort with a relatively low risk of anticipated complications.

## **TQIP Primary and Secondary Outcomes**

**Primary Outcome:** Death during hospitalization, defined by either ED discharge disposition of 'Death' or hospital discharge disposition of 'Expired'.

**Secondary Outcome:** The prevalence of the top ten complications as defined in the National Trauma Data Standard (NTDS). Please note that these data are not risk-adjusted. We will use information derived from the pilot study to determine how best to report risk-adjusted complication rates in the future.

## **Methodology**

The data definitions for variables that were derived based on NTDS are described in detail below. The risk-adjustment methodology, including the significant predictors with odds ratios are presented in this section. In addition,

interpretation of the O/E ratios and W-statistic and the limitations for these analyses are described in this section.

### ***Data Definitions***

Please remember that this report is based upon data submitted to the NTDB. If you feel that there are some inconsistencies in the data please review your data quality report that is posted on the NTDB data center web site ([www.ntdbdatacenter.org](http://www.ntdbdatacenter.org)) or contact NTDB ([tqip@facs.org](mailto:tqip@facs.org)) for further information.

For a detailed description of variables in NTDB and this report please see the National Trauma Data Standard data dictionary, version 1.2.2 ([www.ntdsdictionary.org](http://www.ntdsdictionary.org)). In addition to the variables included in NTDS which are submitted to NTDB there were some derived variables used for consistent inter-hospital comparisons. The derived variables are described below.

### **Mortality**

Patients that died are defined as patients with ED discharge disposition of 'Death' or hospital discharge disposition of 'Expired'.

### **Injury Coding: AIS and ISS**

All centers submit ICD-9 injury diagnoses codes. However, not all participating centers submit AIS codes. To assure consistency in the assessment of injury severity across centers, we use a validated crosswalk (ICDMAP90, 1995 update, John Hopkins University 1997) to derive AIS codes from ICD-9 injury diagnoses codes for all centers, even if AIS codes were submitted to the NTDB. Injury severity score (ISS) is calculated based on these derived AIS scores. As a result, these AIS codes and ISS scores might differ slightly from those submitted directly by participating centers.

### **Mechanism of Injury**

The mechanism of injury is classified according to the Center for Disease Control and Prevention (CDC) matrix of E-code groupings in Appendix 1.

- Blunt: Fall, machinery, motor vehicle traffic, pedestrian, cyclist, and struck by or against
- Penetrating: Cut/pierce and firearm

### **Risk-Adjustment Methodology**

There are differences in baseline characteristics and injury severity of patients at each trauma center. Differences in age, injury mechanism, or severity may all affect the risk profile of patients at one center compared to another. As a result, it is not appropriate to directly compare crude mortality rates across trauma centers. To account for these differences, we used multivariate logistic regression models to estimate the expected number of deaths for each hospital

based on the following characteristics: age (classified as >65 years vs. ≤ 65 years), ISS (>24 vs. ≤ 24), GCS motor score in ED (1 vs. 2-5 vs. 6), systolic BP in ED (0 mm Hg vs. 1-90 mm Hg vs. >90 mm Hg), pulse rate (≤40 bmp vs. > 40 bmp) in ED, maximum head and abdominal AIS severity (no injury vs. 1-2 vs. 3-4 vs. 5-6), and transfer into trauma center status (yes vs. no).

The risk-adjustment mortality model is presented in Table 1. The order of entry of the patient characteristics into the model is based on the c-statistic, representing the ability of that particular parameter to discriminate between survivors and non-survivors. We also present the odds ratio of death and its 90% confidence interval for each predictor variable. An odds ratio is an estimate of the increased risk of mortality for the patient with that particular characteristic. For example, the odds ratio 11.9 for GCS motor score of one, indicates that a patient with a GCS motor score of one in ED had a 11.9 times the odds of dying compared to a similar patient with a GCS motor score greater than one.

There were a total of 15,801 incidents that met the inclusion criteria for this report. However, some incidents had missing values for GCS motor score, systolic BP and pulse rate. For example, 8.7% of these incidents were missing a GCS motor score, 3.6% were missing systolic BP, and 3.4% were missing pulse rate. As missing data are frequently not missing at random and, hence, may be associated with either a good or bad outcome, we imputed missing data. The GCS motor score, systolic BP, and pulse rate were imputed using single imputation techniques. Therefore, the final model included all incidents 15,801 incidents with 1,224 deaths. The c-index for the model was 0.901. The c-index is a measure of how well the model discriminates between deaths and survivors. The c-index generally takes on a value between 0.5 and 1.0, and a c-index of 0.5 means that the model has virtually no discrimination and is no better than flipping a coin. A c-index of 1.0 represents perfect discrimination. The Hosmer and Lemeshow Goodness-of-Fit test was not statistically significant (p=0.622) indicating that the model fit the data well.

**Table 1: Variables Included in the Mortality Prediction Model (all incidents)**

| <b>Variable</b>                    | <b>Odds ratio (90% CI)</b> | <b>C-statistic</b> |
|------------------------------------|----------------------------|--------------------|
| Initial GCS motor score in ED      |                            |                    |
| 1                                  | 11.3 (9.6, 13.3)           | 0.726              |
| 2- 5                               | 4.1 (3.5, 4.8)             | 0.806              |
| 6                                  | Reference                  |                    |
| Initial systolic BP in ED          |                            |                    |
| 0                                  | 16.3 (9.1, 29.4)           | 0.811              |
| 1 – 90                             | 3.6 (3.0, 4.4)             | 0.827              |
| > 90                               | Reference                  |                    |
| Injury severity score              |                            |                    |
| > 24                               | 3.9 (3.3, 4.6)             | 0.857              |
| 9-24                               | Reference                  |                    |
| Age                                |                            |                    |
| > 65 years                         | 5.9 (5.1,6.9)              | 0.890              |
| 16-65 years                        | Reference                  |                    |
| Initial pulse rate in ED           |                            |                    |
| 0 - 40 bpm                         | 6.7 (4.0,11.2)             | 0.891              |
| > 40 bpm                           | Reference                  |                    |
| Mechanism of injury                |                            |                    |
| Firearm                            | 4.3 (3.2, 5.7)             | 0.895              |
| All other mechanisms               | Reference                  |                    |
| Head injury severity (AIS) *       | 1.4 (1.3,1.5)              | 0.899              |
| Abdominal injury severity (AIS)*   | 1.3 (1.2,1.4)              | 0.900              |
| Transfer status                    |                            |                    |
| Transferred from an outside center | 0.9 (0.8, 1.0)             | 0.901              |
| Transported from the field         | Reference                  |                    |

\*Represents the increase in odds of death for each AIS of maximum severity categorized as follows: no injury, 1-2, 3-4, 5-6.

Note: Only characteristics remaining in the stepwise model are represented in this table

The risk-adjustment model in Table 1 was used to estimate the expected numbers of deaths at each hospital for all TQIP patients, and then separately for each of the cohorts. That is, the explanatory variables included in the model were the same for each analysis but their coefficients were recalculated for each patient cohort. The head AIS predictor was omitted from the model when estimating the number of deaths for cohort 2 due to the low frequency of head injuries in this cohort

For each trauma center, the observed mortality rate was then divided by the expected mortality rate to obtain the Observed-to-Expected (O/E) mortality ratio with their 90% confidence intervals. Finally, O/E ratios were plotted on a chart in increasing order. Each trauma center's O/E ratio is highlighted in their individual report, which enables the center to assess its performance compared to their peers.

We also present the *W*-statistic, which estimates the excess (or fewer) deaths in your institution compared to the number expected, for every 100 patients cared for in your center. The *W*-statistic is defined as

$$W = \frac{(\text{observed deaths} - \text{expected deaths})}{(n / 100)}$$

where *n* is the total number of patients from your facility meeting TQIP criteria.

The confidence interval for the O/E ratio was calculated using Ulm's method, which constructs the confidence intervals based on the relationship between Poisson and the Chi-squared distributions for observed events<sup>1</sup>. The confidence intervals for the *W*-statistic is based on the normal distribution<sup>2,3</sup>. In most cases, the interpretation of observed vs. expected number of deaths using the O/E ratio or the *W*-statistic yield the same information. However, as the confidence intervals are calculated based on different methodologies, it is possible that a trauma center might have fewer (or more) deaths than expected for one statistic, but not the other.

#### ***Interpretation of O/E Ratios and the W-Statistic:***

- An O/E ratio with a 90% confidence interval (both lower and upper limit) less than one means we are 90% certain that your O/E ratio is less than one and indicates your trauma center has a lower than expected mortality rate.
- An O/E ratio with 90% confidence interval (both lower and upper limit) greater than one means that we are 90% certain that your O/E ratio is greater than one and indicates that your trauma center has a higher than expected mortality rate.
- An O/E ratio with a 90% confidence interval that overlaps one means that the observed mortality is the same as expected for your trauma center.
- A *W*-statistic with a 90% confidence interval (both lower and upper limit) greater than zero means that we are 90% certain that your *W*-statistic is greater than zero and indicates that your trauma center has more deaths than expected.
- A *W*-statistic with 90% confidence interval (both lower and upper limit) less than zero means that we are 90% certain that the *W*-statistic is less than zero and indicates that your trauma center has fewer deaths than expected.
- A *W*-statistic with a 90% CI that overlaps zero means that the observed mortality is the same as expected for your trauma center.

## **Limitations**

The TQIP report allows centers to compare their outcomes with other hospitals in the pilot study as a measure of quality of care. However, it is possible that factors other than quality of care may influence the risk-adjusted mortality rates. The following limitations must be kept in mind when interpreting your data:

1. **Data quality:** As these data were collected prior to the development and implementation of NTDS and TQIP training of trauma registrars, it is possible that differences in data quality, such as capture of complications or coding of injury diagnosis might contribute to any observed differences in O/E mortality ratios or complication rates.
2. **Selection bias:** The current TQIP report is based upon 23 pilot centers that volunteered to participate in the pilot study. These centers were not randomly chosen; hence, do not represent a typical Level I or II trauma center.
3. **Performance over time:** A trauma center's performance may vary over time. The current report presents a single snapshot in time.
4. **Chance:** Statistical models are simply estimates. It is possible that chance alone led to the position of your center's performance relative to its peers. However, the likelihood of this occurrence by chance alone is less than 10% (based on 90% confidence intervals).
5. **In-hospital outcomes:** O/E mortality ratios are based upon in-hospital mortality. Differences in discharge disposition or access to alternate levels of care might influence in-hospital mortality rates.

## Results: Inter-Facility Comparison

External benchmarking of risk adjusted mortality and the prevalence of the ten most common complications are presented in this section. Facility information for all TQIP pilot study centers with their patient characteristics is also presented.

### *Facility Information for Trauma Centers in TQIP*

There are 23 hospitals included in the TQIP pilot study. Participation was voluntary, and based upon interest and prior participation in NTDB and the TQIP training session held in June in Chicago. Table 2 shows the facility characteristics of the 23 hospitals in the TQIP pilot study

**Table 2: Facility Information for TQIP Hospitals**

|                        | <b>Number of Hospitals</b> |
|------------------------|----------------------------|
| <b>Trauma Level</b>    |                            |
| I                      | 17                         |
| II                     | 6                          |
| <b>Bed size</b>        |                            |
| ≤200                   | 0                          |
| 200-400                | 5                          |
| 401-600                | 6                          |
| >600                   | 12                         |
| <b>Teaching type</b>   |                            |
| Community teaching     | 7                          |
| Community Non-Teaching | 1                          |
| University             | 15                         |
| <b>Hospital type</b>   |                            |
| For profit             | 1                          |
| Not-profit             | 22                         |
| <b>Region</b>          |                            |
| North East             | 5                          |
| Midwest                | 5                          |
| South                  | 7                          |
| West                   | 6                          |

### Patient Information

There were 15,801 incidents across the 23 hospitals. The median number of incidents was 550 and ranged from 192 to 1479 across the hospitals. The patient characteristics of patients cared for in your center compared to all participating centers is shown in Table 3.

**Table 3: Patient Characteristics**

|                                   | Your Hospital | All TQIP Hospitals |                |                |                |
|-----------------------------------|---------------|--------------------|----------------|----------------|----------------|
|                                   |               | Total N (%)        | Cohort 1 N (%) | Cohort 2 N (%) | Cohort 3 N (%) |
| <b>Total number of incidents:</b> | <b>541</b>    | <b>15,801</b>      | <b>2,874</b>   | <b>1,238</b>   | <b>11,689</b>  |
| <b>Age (years)</b>                | <b>N (%)</b>  | <b>N (%)</b>       | <b>N (%)</b>   | <b>N (%)</b>   | <b>N (%)</b>   |
| 16 - 25                           | 94 (17.4)     | 3,386 (21.4)       | 815 (28.4)     | 552 (44.6)     | 2,019 (17.3)   |
| 26- 35                            | 61 (11.3)     | 2,230 (14.1)       | 474 (16.5)     | 304 (24.6)     | 1,452 (12.4)   |
| 36 - 45                           | 88 (16.3)     | 2,189 (13.9)       | 462 (16.1)     | 213 (17.2)     | 1,514 (13.0)   |
| 46 – 55                           | 70 (12.9)     | 2,229 (14.1)       | 427 (14.9)     | 110 (8.9)      | 1,692 (14.5)   |
| 55 - 65                           | 60 (11.1)     | 1,620 (10.3)       | 299 (10.4)     | 38 (3.1)       | 1,283 (11.0)   |
| > 65                              | 168 (31.1)    | 4,147 (26.2)       | 397 (13.8)     | 21 (1.7)       | 3,729 (31.9)   |
| <b>Male</b>                       | <b>N (%)</b>  | <b>N (%)</b>       | <b>N (%)</b>   | <b>N (%)</b>   | <b>N (%)</b>   |
| Female                            | 157 (29.0)    | 5,395 (34.1)       | 944 (32.8)     | 116 (9.4)      | 4,335 (37.1)   |
| Male                              | 384 (71.0)    | 10,402 (65.8)      | 1,930 (67.2)   | 1,122 (90.6)   | 7,350 (62.9)   |
| <b>ISS*</b>                       | <b>N (%)</b>  | <b>N (%)</b>       | <b>N (%)</b>   | <b>N (%)</b>   | <b>N (%)</b>   |
| 9 – 15                            | 130 (24.0)    | 7,612 (48.2)       | 94 (3.3)       | 832 (67.2)     | 6,686 (57.2)   |
| 16 – 24                           | 337 (62.3)    | 5,728 (36.3)       | 951 (33.1)     | 244 (19.7)     | 4,533 (38.8)   |
| >24                               | 74 (13.7)     | 2,461 (15.6)       | 1,829 (63.6)   | 162 (13.1)     | 470 (4.0)      |
| <b>Injury type</b>                | <b>N (%)</b>  | <b>N (%)</b>       | <b>N (%)</b>   | <b>N (%)</b>   | <b>N (%)</b>   |
| Blunt                             | 486 (89.8)    | 14,563 (92.2)      | 2,874 (100)    |                | 11,689 (100)   |
| Penetrating                       | 55 (10.2)     | 1,238 (7.8)        |                | 1,238 (100)    |                |

\*ISS scores were derived from ICDMAP and may differ from the ISS score in your registry

**Table 3 (continued): Patient Characteristics**

|                        |                      | <b>All TQIP Hospitals</b> |                      |                      |                   |
|------------------------|----------------------|---------------------------|----------------------|----------------------|-------------------|
|                        | <b>Your Hospital</b> | <b>Total</b>              | <b>Cohort 1</b>      | <b>Cohort 2</b>      | <b>Cohort 3</b>   |
| <b>Mechanism</b>       | <b>N (%)</b>         | <b>N (%)</b>              | <b>N (%)</b>         | <b>N (%)</b>         | <b>N (%)</b>      |
| MVT                    | 171 (31.6)           | 6,817 (43.1)              | 2,138 (74.4)         | 0 ( 0.0)             | 4,679 (40.0)      |
| Fall                   | 254 (47.0)           | 5,499 (34.8)              | 430 (15.0)           | 0 ( 0.0)             | 5,069 (43.4)      |
| Struck by or against   | 35 (6.5)             | 1,003 (6.4)               | 68 (2.4)             | 0 ( 0.0)             | 935 (8.0)         |
| Firearm                | 14 (2.6)             | 665 (4.2)                 | 0 (0.0)              | 665 (53.7)           | 0 (0.0)           |
| Transport other        | 12 (2.2)             | 913 (5.8)                 | 198 (6.9)            | 0 (0.0)              | 715 (6.1)         |
| Cut/pierce             | 41 (7.6)             | 573 (3.6)                 | 0 (0.0)              | 573 (46.3)           | 0 (0.0)           |
|                        |                      |                           |                      |                      |                   |
| <b>Outcome</b>         |                      |                           |                      |                      |                   |
| <b>Crude Mortality</b> | <b>% (90% CI)</b>    | <b>% (90% CI)</b>         | <b>% (90% CI)</b>    | <b>% (90% CI)</b>    | <b>% (90% CI)</b> |
| All patients           | 9.8<br>(7.8, 12.2)   | 7.7<br>(7.4, 8.1)         |                      |                      |                   |
| Cohort 1               | 13.1<br>(7.9, 20.1)  |                           | 16.4<br>(15.3, 17.6) |                      |                   |
| Cohort 2               | 14.6<br>(7.4, 24.7)  |                           |                      | 12.4<br>(10.9, 14.1) |                   |
| Cohort 3               | 8.3<br>(6.1, 10.9)   |                           |                      |                      | 5.1<br>(4.8, 5.5) |
|                        |                      |                           |                      |                      |                   |
| <b>LOS (days)</b>      |                      |                           |                      |                      |                   |
| Median (IQR)           | 8 (4 – 15)           | 6 (3-10)                  | 9 (5-18)             | 5 (3-10)             | 5 (3-9)           |
| Mean (SD)              | 13.8 (18.2)          | 9.1 (12.2)                | 14.3 (16.2)          | 9.3 (14.4)           | 7.7 (10.3)        |
| <b>ICU LOS (days)</b>  |                      |                           |                      |                      |                   |
| Median (IQR)           | 2 (1-6)              | 3 (2-7)                   | 5 (2-12)             | 3 (2-5.5)            | 3 (1-6)           |
| Mean (SD)              | 5.7 (8.1)            | 6.4 (8.8)                 | 8.8 (10.7)           | 5.88 (8.8)           | 5.3 (7.4)         |

CI: Confidence interval. The Clopper-Pearson confidence interval is used.

IQR: Inter-quartile range (75th to 25th percentile)

SD: Standard deviation

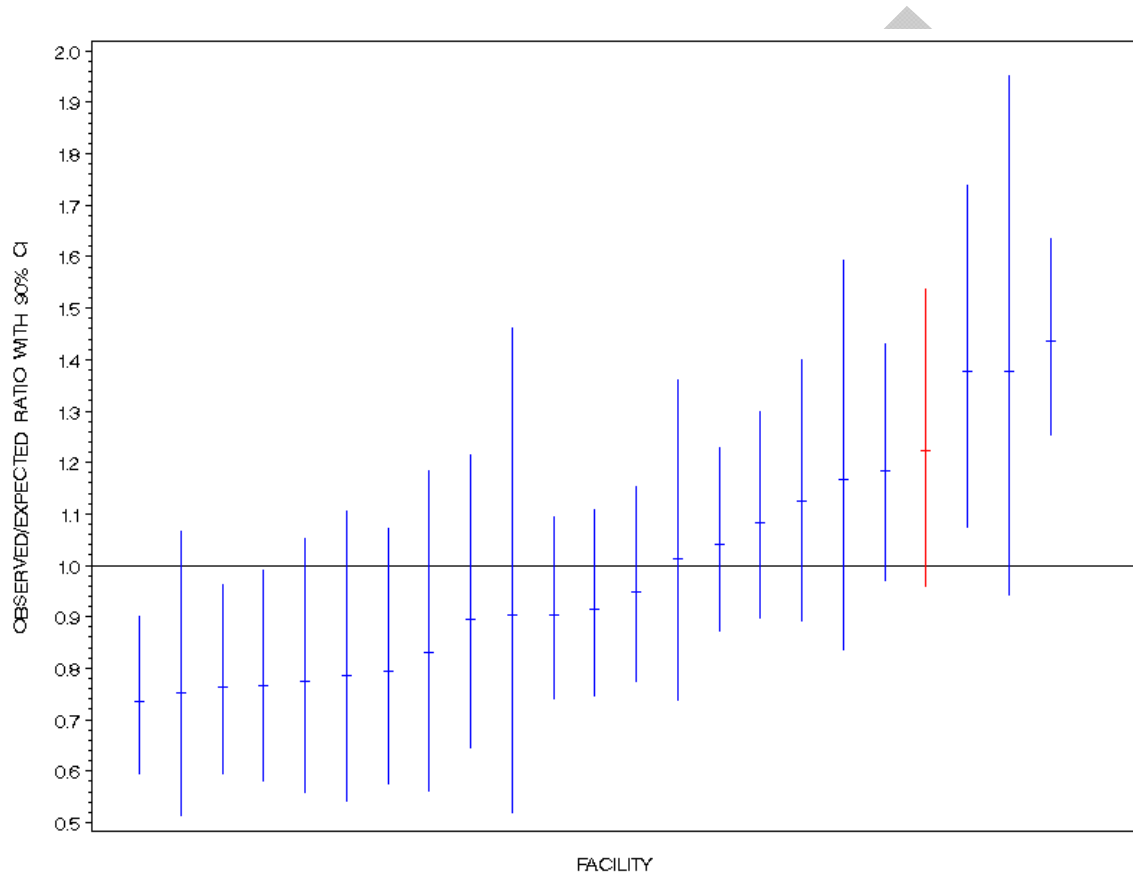
### ***Risk-Adjusted Mortality***

The O/E ratio with the 90% confidence interval for the risk-adjusted mortality is shown in Figures 1 – 4 for all patients, and each of the three cohorts. The W-statistic is also presented.

#### **All Patients:**

**Figure 1: Risk-Adjusted Mortality – All Patients**

(Your facility is shown in red)



O/E ratio with 90% CI = 1.22 (0.96, 1.54)

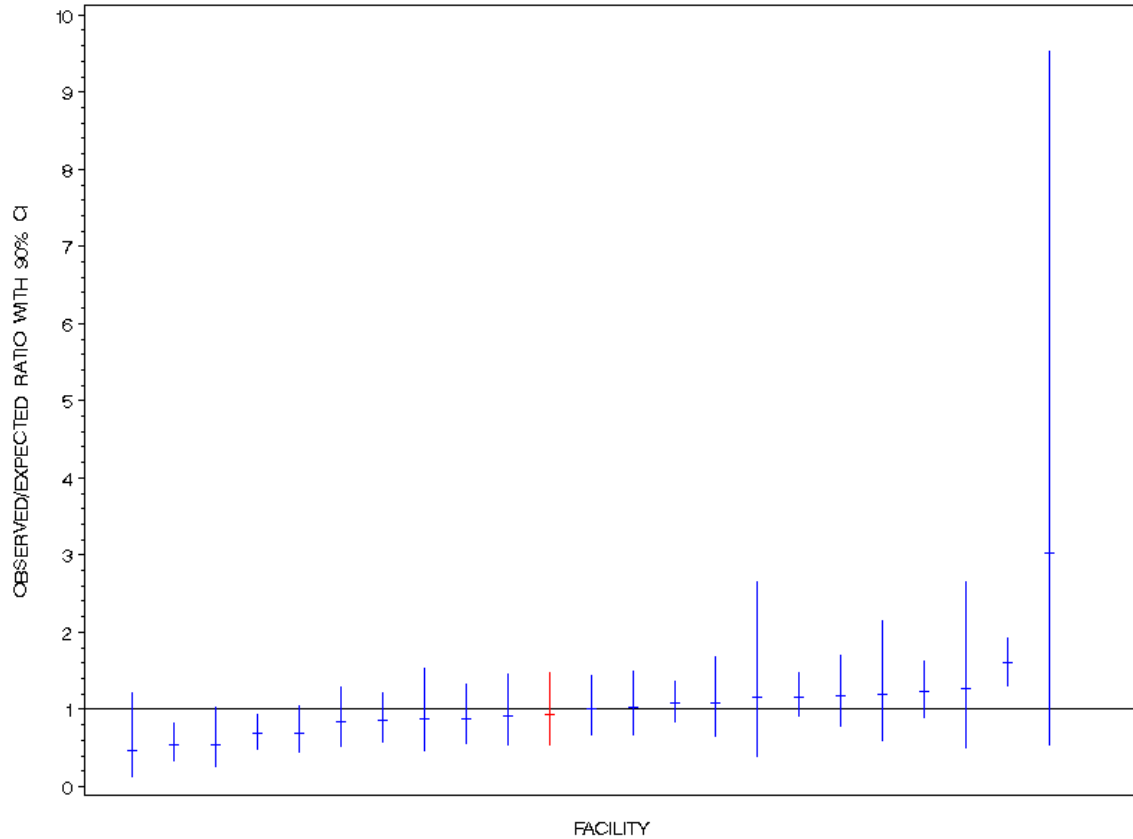
Interpretation: The number of patients that died at your trauma center was the same as expected number of deaths.

W statistic with 90% CI = 1.78 (0.21, 3.35)

Interpretation: The number of patients that died at your trauma center was the same as expected number of deaths.

**Cohort 1:**

**Figure 2: Risk-Adjusted Mortality in Cohort 1 – Blunt Multi System Injuries**  
(Your facility is shown in red)



O/E ratio with 90% CI = 0.93 (0.55, 1.48)

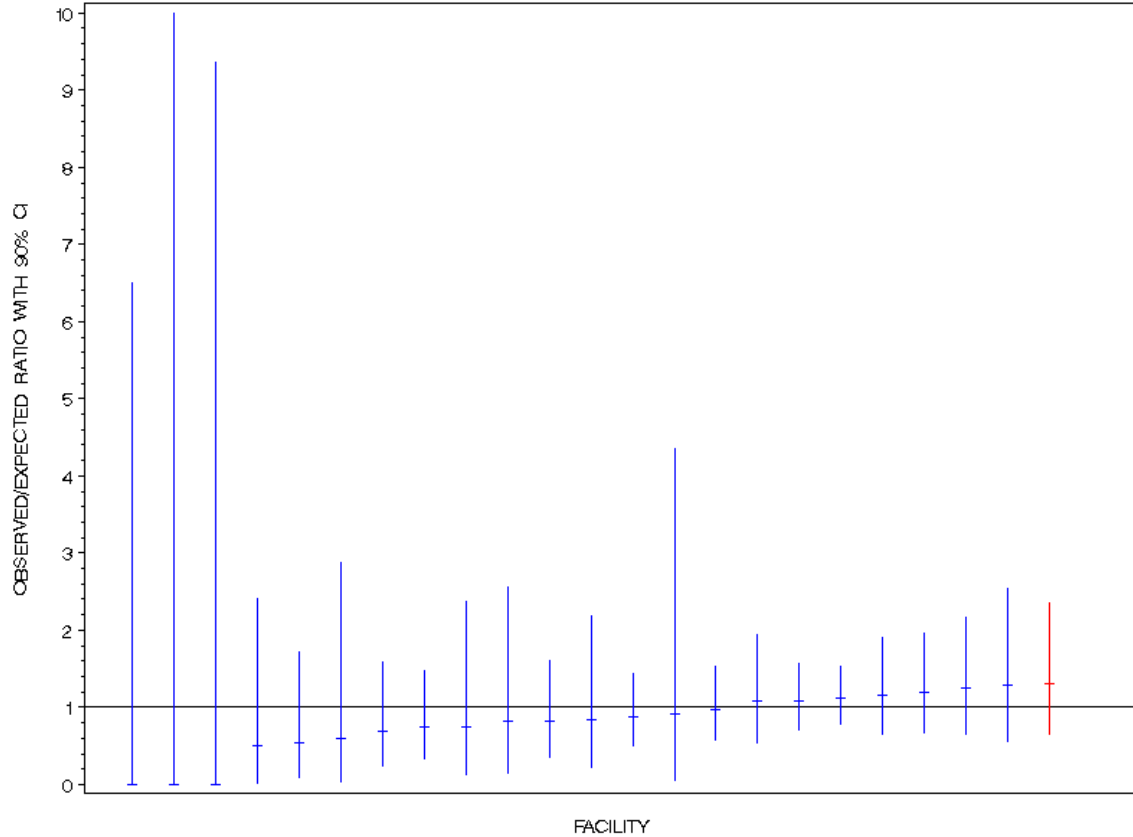
Interpretation: The number of deaths observed at your trauma center is the same as expected in this patient cohort.

W statistic with 90% CI = -0.99 (-5.81, 3.82)

Interpretation: The number of deaths observed at your trauma center is the same as expected in this patient cohort.

**Cohort 2:**

**Figure 3: Risk-Adjusted Mortality in Cohort 2 – Penetrating Injuries**  
(Your facility is shown in red)



O/E ratio with 90% CI = 1.30 (0.65, 2.36)

Interpretation: The number of deaths observed at your trauma center is the same as expected in this patient cohort.

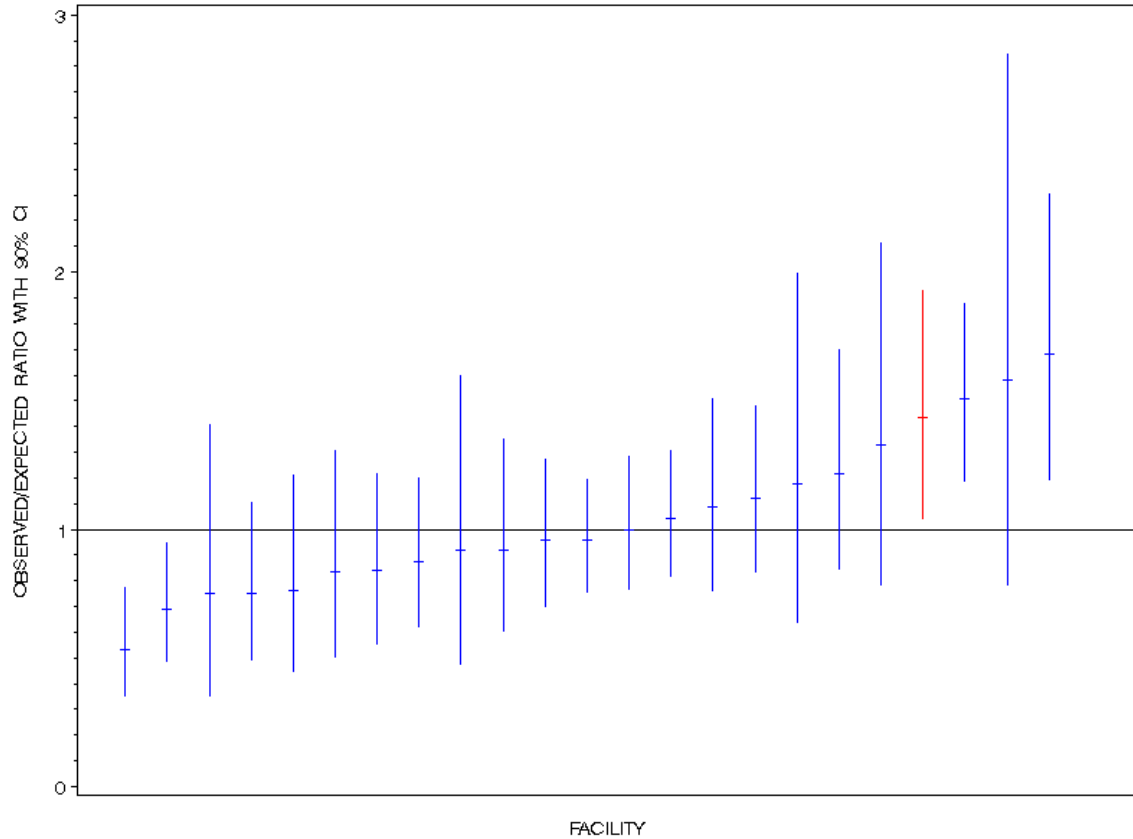
W statistic with 90% CI = 3.40 (-0.82, 7.62)

Interpretation: The number of deaths observed at your trauma center is the same as expected in this patient cohort.

### Cohort 3

**Figure 4: Risk-Adjusted Mortality in Cohort 3 – Blunt Single System Injuries**

(Your facility is shown in red)



## Top Ten Complications

**Table 4: Prevalence of the Top Ten Complications**

|                                     | All TQIP Hospitals |               |              |              |               |
|-------------------------------------|--------------------|---------------|--------------|--------------|---------------|
|                                     | Your Hospital      | Total         | Cohort 1     | Cohort 2     | Cohort 3      |
|                                     | N (%)              | N (%)         | N (%)        | N (%)        | N (%)         |
| <b>Total number of incidents:</b>   | <b>541</b>         | <b>15,801</b> | <b>2,874</b> | <b>1,238</b> | <b>11,689</b> |
| Blank/NR/ND                         | 541 (100)          | 9,167 (54.0)  | 1,469 (43.0) | 758 (56.1)   | 6,940 (56.9)  |
| No NTDS complications               | 0 (0.0)            | 5,115 (30.1)  | 808 (23.6)   | 346 (25.6)   | 3,961 (32.5)  |
| Pneumonia                           | 0 (0.0)            | 614 (3.6)     | 281 (8.2)    | 44 (3.3)     | 289 (2.4)     |
| DVT                                 | 0 (0.0)            | 249 (1.5)     | 111 (3.3)    | 16 (1.2)     | 122 (1.0)     |
| ARDS                                | 0 (0.0)            | 231 (1.4)     | 96 (2.8)     | 19 (1.4)     | 116 (1.0)     |
| Systemic sepsis                     | 0 (0.0)            | 226 (1.3)     | 117 (3.4)    | 26 (1.9)     | 83 (0.7)      |
| Decubitus ulcer                     | 0 (0.0)            | 219 (1.3)     | 88 (2.6)     | 5 (0.4)      | 126 (1.0)     |
| Cardiac arrest                      | 0 (0.0)            | 166 (1.0)     | 87 (2.5)     | 15 (1.1)     | 64 (0.5)      |
| Coagulopathy                        | 0 (0.0)            | 162 (1.0)     | 87 (2.5)     | 31 (2.3)     | 44 (0.4)      |
| Not Applicable                      | 0 (0.0)            | 148 (0.9)     | 40 (1.2)     | 29 (2.2)     | 79 (0.7)      |
| Drug or alcohol withdrawal syndrome | 0 (0.0)            | 146 (0.9)     | 31 (0.9)     | 6 (0.4)      | 109 (0.9)     |

NR=Not recorded  
 ND= Not Done

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## Appendix 1: Injury Intentionality CDC Matrix

This matrix contains the ICD-9 external-cause-of-injury codes used for coding of injury mortality data and additional ICD-9-CM external-cause-of-injury codes, designated in bold, only used for coding of injury morbidity data. In addition, a list of ICD-9-CM external-cause-of-injury codes that have been added since 1994 along with their descriptors is appended to the matrix.

| Mechanism/Cause                      | Manner/Intent                                                |                |                                |              |       |
|--------------------------------------|--------------------------------------------------------------|----------------|--------------------------------|--------------|-------|
|                                      | Unintentional                                                | Self-inflicted | Assault                        | Undetermined | Other |
| Cut/pierce                           | E920.0-.9                                                    | E956           | E966                           | E986         | E974  |
| Drowning/submersion                  | E830.0-.9, E832.0-.9, E910.0-.9                              | E954           | E964                           | E984         |       |
| Fall                                 | E880.0-E886.9, E888                                          | E957.0-.9      | E968.1                         | E987.0-.9    |       |
| Fire/burn <sup>3</sup>               | E890.0-E899, E924.0-.9                                       | E958.1,.2,.7   | E961, E968.0,.3, <b>E979.3</b> | E988.1,.2,.7 |       |
| Fire/flame <sup>3</sup>              | E890.0-E899                                                  | E958.1         | E968.0, <b>E979.3</b>          | E988.1       |       |
| Hot object/substance                 | E924.0-.9                                                    | E958.2,.7      | E961,E968.3                    | E988.2,37    |       |
| Firearm <sup>3</sup>                 | E922.0-.3,.8,.9                                              | E955.0-.4      | E965.0-4, <b>E979.4</b>        | E985.0-.4    | E970  |
| Machinery                            | E919 (.0-.9)                                                 |                |                                |              |       |
| Motor vehicle traffic <sup>2,3</sup> | E810-E819 (.0-.9)                                            | E958.5         | <b>E968.5</b>                  | E988.5       |       |
| Occupant                             | E810.-E819 (.0,.1)                                           |                |                                |              |       |
| Motorcyclist                         | E810-E819 (.2,.3)                                            |                |                                |              |       |
| Pedal cyclist                        | E810-E819 (.6)                                               |                |                                |              |       |
| Pedestrian                           | E810-E819 (.7)                                               |                |                                |              |       |
| Unspecified                          | E810-E819 (.9)                                               |                |                                |              |       |
| Pedal cyclist, other                 | E800-E807 (.3)<br>E820-E825 (.6), E826.1,.9<br>E827-E829(.1) |                |                                |              |       |
| Pedestrian, other                    | E800-E807(.2)<br>E820-E825(.7)<br>E826-E829(0)               |                |                                |              |       |

<sup>1</sup>Includes legal intervention (E970-E978) and operations of war (E990-E999).

<sup>2</sup>Three 4th-digit codes (.4 [occupant of streetcar], .5 [rider of animal], .8 [other specified person]) are not presented separately because of small numbers. However, because they are included in the overall motor vehicle traffic category, the sum of these categories can be derived by subtraction.

<sup>3</sup>Codes in bold are for morbidity coding only. For details see table 2.

<sup>4</sup>E849 (place of occurrence) has been excluded from the matrix. For mortality coding, an ICD-9 E849 code does not exist. For morbidity coding, an ICD-9-CM E849 code should never be first-listed E code and should only appear as an additional code to specify the place of occurrence of the injury incident.

**Note:** ICD-9 E codes for coding underlying cause of death apply to injury-related death data from 1979 through 1998. Then there is a new ICD-10 external cause of injury matrix that applies to death data from 1999 and after. This can be found on the National Center for Health Statistics website at <http://www.cdc.gov/nchs/about/otheract/ice/projects.htm>

| Mechanism/Cause                                 | Manner/Intent                                                                                                           |                                    |                                                                                        |                                  |                                            |
|-------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|------------------------------------|----------------------------------------------------------------------------------------|----------------------------------|--------------------------------------------|
|                                                 | Unintentional                                                                                                           | Self-inflicted                     | Assault                                                                                | Undetermined                     | Other                                      |
| Transport, other                                | E800-E807 (.0,.1,.8,.9)<br>E820-E825 (.0-.5,.8,.9)<br>E826.2-.8<br>E827-E829 (.2-.9)<br>E831.0-.9, E833.0-E845.9        | E958.6                             |                                                                                        | E988.6                           |                                            |
| Natural/environmental                           | E900.00-E909, E928.0-.2                                                                                                 | E958.3                             |                                                                                        | E958.3                           |                                            |
| Bites/stings <sup>3</sup>                       | E905.0-.6,.9<br>E906.0-.4,.5,.9                                                                                         |                                    |                                                                                        |                                  |                                            |
| Overexertion                                    | E927                                                                                                                    |                                    |                                                                                        |                                  |                                            |
| Poisoning                                       | E850.0-E869.9                                                                                                           | E950.0-E952.9                      | E962.0-.9, <b>E979.6,.7</b>                                                            | E980.0-E982.9                    | E972                                       |
| Struck by, against                              | E916-E917.9                                                                                                             |                                    | E960.0; E968.2                                                                         |                                  | E973, E975                                 |
| Suffocation                                     | E911-E913.9                                                                                                             | E953.0-.9                          | E963                                                                                   | E983.0-.9                        |                                            |
| Other specified and classifiable <sup>3,4</sup> | E846-E848, E914-E915<br>E918, E921.0-39, <b>E922.4,.5</b><br>E923.0-.9, E925.0-E926.9<br><b>E928(.3-.5)</b> , E929.0-.5 | E9555, <b>6,.7,.9</b><br>E958.0,.4 | E960.1, E965.5-.9<br>E967.0-.9,<br>E968.4, <b>6,.7</b><br><b>E979 (.0-.2,.5,.8,.9)</b> | E985.5, <b>6,.7</b><br>E988.0,.4 | E971, E978<br>E990-E994, E996<br>E997.0-.2 |
| Unspecified                                     | E887. E928.9, E929.9                                                                                                    | E958.9                             | E968.9                                                                                 | E988.9                           | E976, E997.9                               |
| All Injury <sup>3</sup>                         | E800-E869, E880-E929                                                                                                    | E950-E959                          | E960-E969, <b>E979</b> , E999.1                                                        | E980-E989                        | E970-E978, E990-E999.0                     |
| Adverse effects                                 |                                                                                                                         |                                    |                                                                                        |                                  | E870-E879<br>E930.0-E949.9                 |
| Medical care                                    |                                                                                                                         |                                    |                                                                                        |                                  | E870-E879                                  |
| Drugs                                           |                                                                                                                         |                                    |                                                                                        |                                  | E930.0-E949.9                              |
| All external causes                             |                                                                                                                         |                                    |                                                                                        |                                  | E800-E999                                  |

<sup>1</sup>Includes legal intervention (E970-E978) and operations of war (E990-E999).

<sup>2</sup>Three 4th-digit codes (.4 [occupant of streetcar], .5 [rider of animal], .8 [other specified person]) are not presented separately because of small numbers. However, because they are included in the overall motor vehicle traffic category, the sum of these categories can be derived by subtraction.

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## **Appendix 2: Participating Hospitals**

Cedars-Sinai Medical Center, Los Angeles, California  
Christiana Care, Wilmington, Delaware  
Genesys Regional Medical Center, Michigan  
John Muir Medical Center, Walnut Creek, California  
Massachusetts General Hospital, Boston, Massachusetts  
Miami Valley Hospital, Dayton, Ohio  
Lahey Clinic, Burlington, Massachusetts  
Lehigh Valley Hospital, Pennsylvania  
Maine Medical Center, Portland, Maine  
University of Nevada, Las Vegas, Nevada  
Oklahoma University Medical Center, Oklahoma City, Oklahoma  
Parkland Health and Hospital System, Dallas, Texas  
Regional Medical Center at Memphis, Memphis, Tennessee  
Sharp Memorial Hospital, San Diego, California  
St. John Medical Center, Tulsa, Oklahoma  
St. Michael's Hospital, Toronto, Ontario, Canada  
St. Vincent Mercy Medical Center, Toledo, Ohio  
Truman Medical Center, Kansas City, Missouri  
University of Michigan, Ann Arbor, Michigan  
University of Virginia, Charlottesville, Virginia  
University of California, San Diego Medical Center, San Diego, California  
University of California, Los Angeles Medical Center, Los Angeles, California  
Wake Forest University, Winston-Salem, North Carolina