Exclusive: Field amputation difference between life and death

EMS, fire and hospital personnel describe interstate collision, patient entrapment and field amputation to save a man pinned inside his truck cab by 80,000 pounds of logs

Feb 8, 2017

Editor’s Note:
After reporting the news of a rare field amputation on a remote stretch of Interstate 90 in north Idaho, we contacted Christopher Way, BA, paramedic, and Chief of the Kootenai County EMS System, with questions about the incident. In this exclusive article, Way, joined by other chief officers, physicians and an operating room nurse, give a detailed report of the incident, their actions to save the life of a trapped truck driver by amputating his right leg, and the lessons they want to share about this once-in-a-career incident. This unique rescue was made possible by a unique relationship among all involved.

By Christopher Way, BA, Paramedic, Edward de Tar, MD, FACS, Steve Isaacson, BA, Paramedic, Carmen Sincerbeaux, RN, BSN, MA, Marcus Torgenson, MD, FACS, David Wineinger, MD

Paramedics and firefighters called a trauma surgical team to a cold, slippery mountain pass on the morning of January 19, 2017 to amputate the leg of driver trapped in the sleeper-cab of his truck. The lifesaving field amputation was a first for all involved, a rarity in prehospital care in the United States and has received intense interest from other rescuers.

Our intent is to share exclusive details about the incident, how years of planning for and collaboration on other incidents led to this success and what other providers from
hospital-based trauma teams to fire and rescue professionals to EMS providers can learn from this incident.

FIRST RESPONSE AND SIZE-UP

A field amputation was necessary to remove the drive of a semi after a collision with a log hauler on a remote stretch of I-90 in north Idaho. (All photos courtesy of Kootenai Fire and Rescue)

Units from Shoshone County (Idaho) Fire District #2, under the command of Chief Mark Aamodt, responded to a multi-vehicle accident with injuries involving several semi-trucks. Upon arrival, the responders realized the significance of their situation.

The incident happened just east of the 4th of July Pass in the west bound lanes of Interstate 90 near the Rose Lake interchange and on the Shoshone/Kootenai County line. There were multiple vehicles, mostly semi-tractor trailers, involved and the incident stretched over half a mile of the interstate.

Even with multiple vehicles, there were only two patients that required care and transport. One critically injured patient was immediately removed from the scene and transported by ground ambulance to Shoshone County Medical Center in Kellogg, Idaho — about 17 miles to the east.

At the time of the initial patient transport, there was no way to drive west toward the trauma center in Coeur d'Alene, Idaho because of the accident blocking the east bound
lanes of the interstate. Additionally, air transport was not an option because of the freezing fog and ice that were persistent throughout the incident.

DIFFICULT EXTRICATION OF TRAPPED DRIVER

The focus of rescuers became extricating the driver who was trapped in the sleeper cab of his semi-truck. The accident is still under investigation; it is still unclear what caused the patient’s rig to hit the back of a log truck carrying between 80,000 and 100,000 pounds of logs, but the impact forced the load of logs through the front cab of the truck, pushing the patient still in the driver’s seat to the back wall of the sleeper cab. Both of his legs were trapped under the dash board and weight of the logs that were resting on top.
Realizing the significance of the incident and the need for additional resources, Aamodt called for a heavy rescue R121 unit from Kootenai County Fire and Rescue. The three-person crew, consisting of a Lieutenant, an Engineer/Paramedic and a Firefighter/Paramedic, responded to the scene. Additionally, the KCFR Duty Chief, Division Chief Steve Isaacson, responded to the incident. This was an approximately 40-mile response on icy roads. Thus, taking time to get these resources on scene.

Upon arrival, the R121 crew began to assess the wreckage and prepare equipment for what would become a very difficult extrication. Shoring had already been placed on the semi with the patient and the load of logs however; additional shoring was put in place
to further secure the patient's vehicle and the log hauler. The crew also established IV access and provided pain management to the patient during the extrication.

Upon Chief Isaacson’s arrival, he conferred with command and then the R121 crew and got a situation update. It had taken a full two hours to free the patient’s left leg from its entrapment. After trying different techniques and equipment, rescuers determined that there was no safe way to fully remove the patient from the wreckage. The patient and first responders were all at significant risk by attempting further maneuvers to move the load (logs) on the semi or to attempt to manipulate the patient's position.
FIELD AMPUTATION DECISION

After working for almost three hours since the initial call and significant discussion, the difficult decision that a field amputation was the only way that this patient was going to be safely (for the patient and rescuers) extricated was made. Isaacson was placed in charge of arranging the appropriate response.

Because the scene was on the east side of the 4th of July mountain pass, there was no cellular service and he had to move about a mile and a half to be able to make phone calls to the hospital. He first contacted the Kootenai Health emergency department in Coure d'Alene. Isaacson spoke to one of the emergency physicians. They discussed the situation and agreed that an emergent field amputation was the only option available at that point.

The emergency physician contacted Marcus Torgenson, MD, FACS, the on-call trauma surgeon. Kootenai Health is a Level II trauma center about 30 miles west of the scene. As a designated trauma center, there is always an on-call surgical team available. On the morning of the incident, the operating room was completely open and a full complement of physicians and staff were available.

Isaacson also requested a scene response from Bill Keeley, Division Chief Kootenai County EMS System. Keeley responded to the scene with extra equipment. Chief Chris Way, KCEMSS, responded to Kootenai Health to gather the surgical team and supplies needed at the scene.

FIELD SURGICAL TEAM

Torgenson, the team leader, was joined by trauma surgeon Edward deTar, MD, FACS, anesthesiologist David Wineinger, MD, and Operating Room Nurse Manager Carmen Sincerbeaux. It was important that the rest of the OR continue to function as normal, the trauma center remain open with another trauma surgeon assuming call duties for Torgenson, and that the hospital remain ready for the truck driver, a priority 1 trauma patient who was clearly going to need further surgery.

In addition to the OR personnel, surgical equipment and O-negative blood was gathered for transport to the scene. Prior to leaving the hospital, it was communicated to Isaacson that although the patient was not actively bleeding, two tourniquets should be placed on the patient's trapped leg to facilitate the ensuing surgical procedure. Time
from the initial call to the emergency department until the surgical team was leaving the trauma center, en route to the scene, was 34 minutes.

During the trip to the scene, Torgenson made some crucial decisions about the procedures he would use and discussed his thought process with de Tar. He discussed sedation and intubation options with Wineinger and made sure that Sincerbeaux had the equipment needed to utilize the techniques he wanted. It was also discussed that a quick decision on whether to transport to the emergency department or go directly to the OR with the patient was needed to ensure appropriate resources were available and ready.

**PRE-AMPUTATION SAFETY BRIEFING**

Upon arrival at the incident, a very quick safety briefing was given to the hospital personnel. Fortunately, all of the KCFR and KCEMSS Chief Officers have both structural and wildland firefighting gear and the physicians who would be working on the patient were loaned PPE. Torgenson and Wineinger entered the sleeper cab, quickly assessed the patient and determined that due to the patient’s position and inability to access his head that conscious sedation would be used for the surgical procedure.
FIELD AMPUTATION PROCEDURE

Wineinger established an additional IV to administer ketamine and propofol to achieve sedation. Torgenson and de Tar prepped the patient for the procedure.

To access the patient’s right leg, of which only a few inches below the knee were exposed, Torgenson reached the patient from the passenger side of the vehicle, laid on his left side across the wreckage and crawled under the crushed dashboard/steering column/overlying logs. This position gave him direct access to the patient's right knee.
joint while deTar provided exposure of the knee joint and lighting from the driver’s side of the semi.

An EMS stretcher was placed close by to serve as a table for the surgical tools. One of the photos from the incident shows Sincerbeaux with the surgical tools.

Due to the limited patient access and the weight of the load on the patient, it was quickly determined that a through the joint amputation would be done. At this time, an ALS ambulance from Kootenai County, Northern Lakes Fire Medic 51, was positioned to receive and transport the patient. Idaho State Police and Idaho Department of Transportation closed the east bound lanes of I-90 so that the ambulance could be placed close to the scene and have egress from the incident. The ambulance was also warmed and the blood was placed in the IV warming drawer knowing that the patient had been exposed to the elements for a significant amount of time at this point.
The surgical procedure took less than 10 minutes with no unforeseen complications and minimal external blood loss. Post amputation, a little more extrication took place to facilitate patient movement. Once that was completed, the patient was quickly moved to an EMS stretcher and placed in the pre-positioned, warm ambulance.

**TRANSPORT TO THE EMERGENCY DEPARTMENT**

Wineinger and the ambulance crew successfully intubated the patient while Torgenson and Sincerbeaux dressed and covered the wound to prepare for transport. O-negative blood was given and the tourniquets were left in place during transport. The care team also determined that because of the patient’s potential for other injuries and hypothermia that it was more appropriate to evaluate him in the trauma room in the emergency department rather than go directly to the operating room.

Torgenson and Wineinger, along with the M51 paramedic, transported the patient. Way transported the other surgical team members back to the hospital so they could assist in continuing patient care and surgery.

**INCREDIBLE RELATIONSHIPS LEAD TO INCREDIBLE SUCCESS**

From the time of surgical team arrival on scene until the patient was being transported to the trauma center was less than 40 minutes. For the personnel on scene, it didn’t seem that long. The entire trip to and from Kootenai Health took no longer than 100 minutes.

Part of the reason for the relatively short response, scene and transport time — this happened on a very remote stretch of north Idaho interstate — and the overall success of this incident was the incredible relationship all of the responders share with each other. While this was the first time they had done something of this magnitude together, they are fortunate to work in a collaborative environment where other efforts had prepared them to know and respect each other.

**COLLABORATIVE PLANNING, TRAINING, COMMUNICATION AND RESPONSE**

This wasn’t the first time that week that many of the same people had worked together on a multi-victim trauma incident.

EMS is a regular and contributing member of Kootenai Health’s trauma committee. The physicians — surgeons, ER and anesthesia — are also all members of that committee and met the day before the incident for a trauma meeting. The hospital is supportive
and encouraging of these relationships and the communication it takes to maintain them. Again, a significant part of the successful outcome for this patient can be attributed to the importance placed on relationships, collaboration, communication and the teamwork that were displayed in this incident.

6 LESSONS LEARNED

There were many lessons learned that are equally important to share.

1. PRE-PLAN

Pre-plan for as many different types of incidents as you can. In this case, the surgical procedure itself didn’t need discussion, but advance planning for a field amputation — who and what equipment from the OR to take to a scene — could have saved a few minutes.

2. ACTIVATE ADDITIONAL RESOURCES EARLY

Although a difficult decision, sometimes calling for additional resources from fire, EMS and the hospital early will save time.

3. EXTRA PPE

The surgical team was fortunate to have a small amount of extra PPE, but that could have easily not been the case and difficult decisions would have to be made about the level of protection available/provided.

4. HOT WASH

Conduct a quick and informal hot wash because of the number of agencies/personnel involved. If possible, include the hospital personnel in the hot wash.

5. ONGOING MONITORING, ASSISTANCE

Agencies need to implement some form of monitoring responders. This was a high-acuity low-(almost never)-frequency call and ensuring the health of the responders, including hospital staff, is paramount.

6. COMMUNICATIONS PRACTICE, LIMITATIONS
Finally, practice communications. In this case, there was no cellular phone service without leaving the scene which made communication with the hospital difficult. The 700 MHz digital radio system worked very well to talk to the emergency department, but the on-scene personnel were not able to talk to the surgical team physicians directly until Way arrived at the hospital.

The patient is expected to make a full recovery after an additional surgery and rehabilitation. The fire and EMS crews did a remarkable job of securing the scene and making the very difficult determination that a surgical field amputation was needed. The physicians and nurse were put in an unusual situation with lots of people in an unfamiliar environment and performed flawlessly. This was all possible because of the emphasis placed on relationships and inclusion of EMS in the local health care system.

About the authors
Chief Christopher Way, BA, has been in EMS for 25 years and is a paramedic. He has been the Chief of KCEMSS for just over three years.

Edward de Tar, MD, FACS, has been at Kootenai Health as a general/trauma surgeon for over 10 years. Previously he was as a physician in the U.S. Army serving two tours in the Middle East.

Chief Steve Isaacson, BA, paramedic, has been in EMS for almost 40 years and has been the EMS Division Chief at KCFR for almost two years.

Carmen Sincerbeaux, RN, BSN, MA, has been at Kootenai Health for over 10 years and is the OR Nurse Manager.

Marcus Torgenson, MD, FACS, has been at Kootenai Health for seven years as general/trauma surgeon. He graduated medical school from the Washington University in St. Louis and completed his surgical residency at the University of Utah.

David Wineinger, MD, has been at Kootenai health since the early 2000’s and graduated medical school and residency at the University of Kansas.
How Americans get hurt

Most disproportionately common physical injury diagnosis in each state, as documented in health insurance claims.
Trauma Registry Q&A: “How can we use registry reports to perform data validation?”

BY TRAUMA NEWS ON MARCH 17, 2017

Ongoing data validation is essential to ensuring the quality of a trauma registry. In January’s Q&A column, the trauma registry experts at Pomphrey Consulting clarified what the American College of Surgeons expects regarding data validation. This month, they explain how to use registry software reports to ensure data quality from a structural point of view.

Q. Which reports should be part of our data validation plan?

Trauma registrars, data analysts and program managers should focus on two kinds of reports — National Trauma Data Bank (NTDB) Validator reports and “data cleaning” reports.

Validator reports use NTDB edit checks that have been built into your registry software. Data cleaning reports are other reports you can run using your software’s reporting functionality. Both report types help you perform data validation by flagging errors and common data quality problems.

Q. How do you use NTDB Validator reports in data validation?

First, run the NTDB Validator report and save it. Then, depending on your software, you can either open the error log in Excel or upload the XML file at the NTDB Data Center and click “Submit”. The NTDB system will generate a report that lists your errors. Your data will not actually be submitted to the NTDB until you “Accept” the file. Either method allows you to see your errors. (Just remember that the NTDB Validator report only identifies schematic errors.)
Next, investigate and resolve the errors listed in the Validator report. The report flags four different categories of errors:

- **Level 1 flags** are format or schema errors. These errors often involve values that are outside of the valid range — for example, a patient age value that is greater than 120 years.
- **Level 2 flags** identify errors in data fields that help determine whether the patient file meets the NTDB inclusion criteria or that are required for critical analyses. For example, the NTDB will not accept patient files if the race, sex or ethnicity field is blank.
- **Level 3 flags** identify “major logic” errors. For example, if *Report of Physical Abuse* is marked “Yes,” then the *Investigation of Physical Abuse* field cannot be marked “Not Applicable.”
- **Level 4 flags** identify “minor logic” errors. For instance, the Validator will generate a Level 4 flag if the *EMS Unit Arrival on Scene Time* is earlier than the *EMS Dispatch Time*.

Level 1 and Level 2 flags must be resolved before the data file can be submitted to the NTDB. Level 3 and Level 4 flags indicate potential problems with a data file. The NTDB will still accept a file with Level 3 or 4 flags, but checking these fields and resolving any errors will help ensure the quality of your data.

For example, your NTDB Validator report flags a Level 3 error for *ED/Hospital Arrival Date* because it is greater than 30 days from the *Injury Incident Date*. Upon investigation, you might find that this field includes a typo that should be corrected. Alternatively, you might find that the date is correct as entered, because the acute trauma patient stayed at an outside hospital for 31 days and then transferred to your facility once stable enough to be closer to home. The point is to check the flag and correct the data if needed.

The [NTDB Data Dictionary](#) provides helpful guidance on resolving errors. Appendix 2 explains the meaning of each error flag for each data field. For example, say you run a Validator report on a patient file and it returns a Level 1 flag for the *Cryoprecipitate Measurement* field. Find that field in Appendix 2. There, you will see that a Level 1 flag for this field means that “the value is not a valid menu option.”

**Q. How do you use “data cleaning” reports in trauma data validation?**

While Validator reports are crucial to checking data submitted to the NTDB, they do not cover any non-NTDB data that your hospital is collecting. To validate your hospital-specific registry data, you need to run additional data cleaning reports.

Use your registry software’s reporting functionality to run reports on common problem areas. We recommend running two standard reports: blank fields and “Not Known/Not Recorded” (NK/NR) fields.

After you run these reports, step one is to resolve as many blanks and NK/NR fields as possible. For example, pre-hospital data fields are often blank because the EMS trip sheet is not available when the registrar abstracts the patient chart. The data cleaning report can be an effective reminder to go back and capture this information.
Step two is to use blank and NK/NR reports to identify performance improvement opportunities. Which fields are consistently blank or inappropriately marked as unknown? This can point to either a registrar problem or a documentation problem. It also indicates where further training or education is required.

Data cleaning reports can also be used to identify blanks that affect trauma type (blunt versus penetrating). Without this essential documentation, probability of survival — and thus your M and Z statistics — cannot be calculated. Registry managers can also use data cleaning reports to validate data on highest level of trauma activation and attending presence, which are critical for ACS compliance.

**Q. How often should we run these registry reports?**

Trauma registry managers or staff members should run data validation reports — and resolve identified errors — on a monthly basis.

Why? In our experience, many trauma programs check their registry data only once a year, when they submit data to the NTDB. Not uncommonly, the report flags more than 1,000 errors. Resolving all these errors can take days, creating last-minute problems when there is little time to spare.

Establishing a monthly reporting process enables the registry team to perform data validation in manageable batches. It gives staff time to focus on performance improvement opportunities, and it signifies a “closed” month with clean data.

*Trauma Registry Q&A* is a bimonthly column produced in partnership with Pumphrey Consulting, a comprehensive trauma registry company which provides training and trauma registry management. The American College of Surgeons has recognized our Trauma Registrar Mentorship Program for meeting the trauma registrar course requirement of CD15-7. Our course is revised each year to meet any and all ACS NTDB changes, as well as the demands of the ever-changing world of trauma registries. Our program also includes full trauma registrar training in ICD-10-CM and ICD-10-PCS. To visit our website, [click here](https://example.com).
Figure 1  The most distinctive Injury death in each state. *Defined as the injury death for which the state death rate is the largest multiple of the national death rate.
National Association of State EMS Officials

Status of State Trauma System Planning and Development

Utilization of the HRSA Model Trauma System Planning and Evaluation Document

September 2016
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I. Executive Summary

“The neglected disease of modern society.”

Injuries, including all causes of unintentional and violence-related injuries combined, account for 59% of all deaths among people ages 1-44 years of age in the U.S.—that is more deaths than non-communicable diseases and infectious diseases combined. Injuries killed more than 199,800 in 2014—one person every three minutes, according to the Centers for Disease Control and Prevention (CDC). In addition, 2.5 million people were hospitalized and 26.9 million people were treated in emergency departments for injuries in 2014. Injury and violence also has an alarming economic toll. The total costs of injuries and violence in the United States was $671 billion in 2013. The costs associated with fatal injuries were $214 billion while nonfatal injuries accounted for over $457 billion1.

In 1966, the National Academy of Science National Research Council Committees on Trauma and Shock published “Accidental Death and Disability: The Neglected Disease of Modern Society,” a report that influenced the development of modern emergency medical services (EMS) and trauma systems. In 2004, the National Highway Traffic Safety Administration (NHTSA) noted, “A trauma system is an organized, coordinated effort in a defined geographic area that delivers the full range of care to all injured patients and is integrated with the local public health system. The true value of a trauma system is derived from the seamless transition between each phase of care, integrating existing resources to achieve improved patient outcomes. Success of a trauma system is largely determined by the degree to which it is supported by public policy.” The Health Resources and Services Administration (HRSA) presented the HRSA Model Trauma Systems Planning and Evaluation (MTSPE) in 2006 and while the federal Trauma-EMS System Program was largely defunded shortly thereafter, the Model continues to serve as a foundation/guide for states in assessment with strategic planning and tactical planning with implementation.

In an effective system, trauma care delivery is organized through the entire spectrum of care delivery from injury prevention to pre-hospital care, care at all acute care facilities and trauma centers, and rehabilitation. The system begins with a State’s authority to designate various levels of trauma and burn centers so that through data collection and analysis processes, the system demonstrates its own effectiveness. NASEMSO supports the concept of an inclusive trauma care system, meaning that every acute care hospital routinely provides services to traumatically injured persons and is thus included in the trauma system. True trauma system integration means that no matter where in the United States trauma occurs, the patient is assured expeditious transport to the level of care that is commensurate with their injury.

I. Executive Summary

In this monograph, we examine the general status of formal trauma system development in the states, and particularly the utilization of system development tools produced by HRSA and NHTSA. To the extent possible, we will compare our results with data collected in 2010. In understanding the findings, there are two main caveats:

First, formal trauma systems do not exist in all states, and the state EMS office is not always the administrative repository of all trauma system components. In some cases, elements of the trauma system such as prevention, data analysis, and disaster preparedness are organizationally situated elsewhere.

Second, because the state trauma systems that do exist evolved more or less organically, the systems are often not directly comparable. Each system has standards, criteria and requirements that have been uniquely developed to meet the political and fiscal realities of each state. This is true of state EMS systems in general. As a result, the definitions of terms, the inclusion and exclusion criteria for data systems, and processes for recognition of trauma centers are all quite different.

The assessment tool was designed to elicit information that would be useful in achieving an understanding of the general status of these systems. Related questions have been integrated at the beginning of each section throughout the document. The purpose of this endeavor is neither to judge nor to rank the various trauma systems. Neither is it the intent to provide specific recommendations; but rather to contribute to a clearer understanding of what exists, so that both the challenges and opportunities of future system development can be more fully appreciated. Results of the assessment are summarized in the sections below. The use of thumbnail graphics is used to conserve space within this document. A viewable set of the images can be obtained at [http://nasemso.org/Resources/Monographs/](http://nasemso.org/Resources/Monographs/).

The assessment population consisted of trauma system managers or the state EMS director. Data was collected in May 2015. Of the potential pool of 50 states, 41 full or partial responses were collected for an overall return rate of eighty two percent. NASEMSO expresses deep appreciation for all those who responded: Alabama, Alaska, Arizona, Arkansas, California, Colorado, Delaware, Florida, Georgia, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maryland,
I. Executive Summary


NASEMSO sincerely thanks the American Trauma Society for technical assistance in the preparation of this report.

Finally, the collection, analysis, and presentation of state data would not have been possible without the support of the U.S. Department of Transportation National Highway Traffic Safety Administration, Office of Emergency Medical Services. We are grateful for their ongoing commitment to support statewide trauma systems and quality trauma care across the Nation.

This monograph was developed by the NASEMSO Trauma Managers Council with Support from the Office of Emergency Medical Services National Highway Traffic Safety Administration U.S. Department of Transportation DTNH22-11-H-00338-0001
II. State Trauma Programs

“The concept of inclusive trauma care systems promotes regionalization of trauma care, so that all areas of the country receive the best possible care.”

This section addresses the findings from the following assessment questions (Click HERE to skip questions and go to narrative):

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<thead>
<tr>
<th>Question</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q7 Where is your office &quot;administratively&quot; located?</td>
<td>State Health Department, Other state agency, Outside entity (such as state hospital association, foundation, etc)</td>
</tr>
<tr>
<td>Q8 What is your level of accountability to your state’s bureau or office of EMS (please check best answer)?</td>
<td>Our functions are located within the state EMS office, We work collaboratively with the EMS office but do not administratively report to them, We are totally separate from the EMS office and interface with multiple state agencies, If &quot;Other&quot; please explain</td>
</tr>
<tr>
<td>Q9 What is the number of staff (FTE) positions assigned to the state trauma program? (Numerical data only, if none, use 0)</td>
<td>Total, Administrative/management (including Director), Medical director dedicated to the trauma program, Medical director with shared responsibilities to Office of EMS, General program staff (excluding admin/IP/data), Facility designation, Data/Registry, Quality Improvement, Epidemiologist, Injury Prevention, Public Information, Multiple responsibilities</td>
</tr>
<tr>
<td>Q10 What &quot;time sensitive&quot; systems are coordinated by your state?</td>
<td>Trauma (adult and pediatric trauma including burns), STEMI, Stroke, Other</td>
</tr>
<tr>
<td>Q11 Is the state trauma program involved in injury prevention efforts (i.e. falls, motor vehicle safety, &quot;Toward Zero Deaths&quot;, etc)?</td>
<td>Yes, No</td>
</tr>
<tr>
<td>Q12 Is the state trauma program involved in public information and education efforts besides injury prevention? (Such as educating the public on why trauma centers are important, injury/fatality rates, prevalent injury patterns in the state, survivor resources, comparison of outcomes data trauma center vs. non-designated, etc.)</td>
<td>Yes, No</td>
</tr>
<tr>
<td>Q13 Does the state trauma program have an identified role in the state disaster response plan?</td>
<td>Yes, No</td>
</tr>
<tr>
<td>Q14 Does the state trauma program have a Mass Casualty Incident plan?</td>
<td>Yes</td>
</tr>
</tbody>
</table>
II. State Trauma Programs

Q15 What uniform disaster triage guideline is used in your state?
   - START
   - SALT
   - We do not have a uniform disaster triage guideline used in our state
   - If Other (please describe)

Q18 For the current federal fiscal year, (October 1, 2014-September 30, 2015) from which federal sources is your trauma program receiving grant support?
   - Office of Rural Health
   - Maternal and Child
   - Highway Safety 402
   - Highway Safety 408
   - CDC
   - DHS
   - ASPR
   - EMSC
   - Preventive Health Block Grant
   - None
   - If Other (please specify)

Q19 For what purposes does your state trauma program use social media (i.e. Facebook, Twitter, Instagram, etc)?
   - Highlight accomplishments
   - Communicate with stakeholders and/or the public
   - Trauma prevention messaging
   - Promote educational opportunities
   - Our state trauma program doesn't use social media
   - Other

Q20 Does your state have legislative authority (enabling legislation and rules) to designate trauma centers?
   - Yes
   - No

Q22 Does your state have the legislative authority to limit the number of trauma centers?
   - Yes
   - No

Q34 Does your state have a state trauma plan? (Please choose best answer)
   - Yes, we have a standalone state trauma plan
   - Yes, trauma is part of the state EMS (or similar) plan
   - We are in the process of developing a state trauma plan
   - No, we do not have a state trauma plan

Q35 If your state has a state trauma plan or is developing one, under what national guidelines was this plan developed?
   - The "Model Trauma System Planning and Evaluation" document (HRSA, 2006)
   - Regional Trauma Systems: Optimal Elements, integration, and Assessment guidance document (ACS-COT, 2008)
   - Our state does not have a state trauma plan nor are we developing one
   - If "Other guidelines" (please specify the source)

Q36 If the "Model Trauma System Planning and Evaluation" (MTSPE) document was used, has your state completed the Benchmarks, Indicators, and Scoring (BIS) assessment?
   - Yes
   - No
   - MTSPE does not apply to our state

Q37 Does your state have a STATEWIDE stakeholder group (i.e. Board or advisory committee) with a special interest in trauma system policy?
   - Yes, it is mandated by rule or legislation
II. State Trauma Programs

- Yes, such a group exists informally/voluntarily (i.e. hospital association or other entity coordinates activities)
- No, our state does not have a statewide stakeholder group for trauma

Q38 Does your state have a REGIONAL stakeholder group (i.e. Board or advisory committee) with a special interest in trauma system policy?
- Yes, it is mandated by rule or legislation
- Yes, such a group exists informally/voluntarily
- No, our state does not have a regional stakeholder group for trauma

Q39 On which of the following groups is injury rehabilitation expertise represented in your state?
- Trauma Advisory Committee
- Trauma Data/Trauma Registry Committee
- Performance Improvement Committee
- Education Committee (for trauma professionals and staff)
- Injury Prevention Committee
- Public Education Committee
- None of the above

1. State Trauma Program Organization and Authority

States assumed a primary role in trauma systems development following the release of federal guidance documents in 2004 and 2006. Over the next several years, federal support and funding for trauma systems development dwindled and responsibility for trauma system integration largely shifted to the states. In 2015, State Health Departments were recognized as the administrative “home” for eighty percent (Fig. 1, 2) of state trauma programs although fifteen percent reported administrative support from another state agency, and four percent were located in a non-governmental entity such as a state hospital association or foundation. In the same period, the average number of full time equivalent (FTE) state trauma program staff was 5, inclusive of an administrative lead, general program staff, facility designation, data/registries, an epidemiologist, and persons that fulfill multiple job functions (Fig. 3). This is a fifty-nine and one half percent increase in full time equivalent staff from 2010. 36 states (ninety percent of respondents) have legislative authority (enabling legislation and rules) to designate trauma centers (Fig. 4.) Only 8 states currently report the legislative authority to limit the number or location of trauma centers (Fig. 5.)
2. State Trauma Plan

Fifty percent of respondents indicate the availability of a State Trauma Plan. An additional thirteen percent of respondents report that trauma is integrated into the state EMS plan while eighteen percent report that the development of a state trauma plan is currently in progress. Eighteen percent of respondents reported not having a state trauma plan (Fig. 6.) Overall, the use of state trauma plans has increased seventeen percent since 2010. In 2015, forty two percent of respondents utilized the “Model Trauma System Planning and Evaluation” (MTSPE) and companion Benchmark Indicator and Scoring (BIS) assessment last revised by HRSA in 2006 as the basis for their state trauma plan. Twenty one percent of respondents utilized the American College of Surgeons Committee on Trauma (ACSCOT) “Regional Trauma Systems: Optimal Elements, Integration and Assessment” 2008 guidance document as the basis for the state trauma plan. Twenty nine percent of respondents reported utilized a combination or custom approach to their state trauma plan. The utilization of the MTSPE and BIS assessment in state trauma plans appear to have decreased by thirty seven percent, in part, because the tools have not been updated in 10 years. Twenty nine percent of respondents are now using a combination of documents, including plans from other states as models for state trauma planning (Fig. 7.)
3. Use of Statewide and Regional Advisory Committees

Eighty-nine percent of respondents (n=34) have a statewide stakeholder group (i.e. Board or advisory committee) with a special interest in trauma system policy that is mandated by rule or legislation (Fig. 8.) Another eight percent of respondents (n=3) note this entity exists on a voluntary basis and only 1 respondent indicated this body doesn’t exist in the state. The majority of statewide groups (n=15) meet on a quarterly basis, 2 meet every month, 2 meet bimonthly, 1 meets every 6 months, and 1 meets 3 times a year. Other frequencies were not specified.

Similarly, fifty-three percent of respondents (n=20) have a regional advisory group that is mandated by rule or legislation; another eighteen percent (n=7) report a voluntary group and twenty nine percent of respondents (n=11) do not have a regional stakeholder group for trauma (Fig. 9.) The majority of regional trauma groups meet on a quarterly basis.

Finally, the states were polled to determine the involvement of injury rehabilitation specialists serving the multiple needs of the statewide and regional panels. Findings demonstrated involvement in the areas of the State Trauma Advisory Committee and State Injury Prevention Committees (Fig. 10.)
4. Time Sensitive Conditions

In 2006, the National Academies of Medicine (formerly the Institute of Medicine) considered emerging models of (health care) regionalization and recommended that the federal government implement a regionalized emergency care system to improve cooperation and overcome the challenges of overcrowded emergency departments (EDs) while reducing morbidity and mortality for patients with time sensitive conditions such as ST Elevation Myocardial Infarction (STEMI), stroke, and pediatric emergencies. In a regionalized system, local hospitals and EMS providers would coordinate their efforts so that patients would be brought to hospitals based on the hospitals’ capacity and expertise to best meet patients’ needs. The regionalization of care related to time sensitive conditions beyond trauma were not contemplated in the 2010 NASEMSO Monograph. Since that time, states have begun to coordinate system activities related to time sensitive conditions and the majority of these programs are functional as a component of the state trauma program. More states are implementing separate program offices—however, describing the organization and funding of these activities is beyond the scope of this document. (Fig. 11, 12, 13, 14.)
5. Injury Prevention, Public Information & Education (PI&E), and Use of Social Media

Injury prevention and public information and education is considered a related function in more than half of state responses. Sixty nine percent (n=27) report injury prevention activities related to fall prevention, motor vehicle safety, and involvement in the Toward Zero Deaths initiative (Fig. 15.) This activity is decreased by twenty percent from 2010 and comments suggest these activities are secondary functions of the trauma program and coordinated with state brain and spinal cord injury programs, violence prevention, and highway safety offices. Forty six percent of respondents (n=18) report involvement in data analysis, identification of injury and referral patterns, and conference and meeting participation that involves EMS personnel, legislators, and/or the public (Fig. 16); a ten percent decrease from the 2010 study.

Federal agencies such as the Centers for Disease Control and Prevention (CDC) have recognized the power of social media, using the broad reach of the online community to help distribute important health information. State health departments widely use social media to reach different segments of the population on a range of health topics, however, it appears this effort is not wide spread among state trauma programs as nearly eighty percent of respondents indicated they do not use social media. Those that promote messaging electronically use it to communicate with stakeholders and/or public (fifteen percent), communicate accomplishments (ten percent), promote educational opportunities (ten percent), and trauma prevention messaging (seven percent).
6. Integration with State Disaster Preparedness Planning

While trauma centers are considered an integral component and asset in large-scale disasters, a role for the state trauma program has not been clearly delineated in most state disaster response and preparedness plans. Similar to 2010, only thirty three percent of respondents (n=13) have an identified role in their state disaster response plan (Fig. 17.) It seems that elements of the trauma system (trauma centers and personnel), rather than the trauma program at the state level, play a greater role in a mass casualty response. Even fewer state trauma programs have their own Mass Casualty Incident plan, as the majority of these functions are coordinated by other state entities, such as the offices of public health preparedness and/or emergency management (Fig. 18.)

According to the Federal Interagency Committee on Emergency Medical Services (FICEMS), the Model Uniform Core Criteria (MUCC) for Mass Casualty Triage is a science and consensus-based national guideline that recommends 24 core criteria for all mass casualty triage systems. While twenty three percent of respondents indicate that a uniform disaster triage guidelines is not currently in place in their state, fifty four percent of respondents utilize “Simple Triage And Rapid Treatment” (START), five percent utilize “Sort, Access, Lifesaving Interventions, Treatment/Transport” (SALT), and eighteen percent don’t utilize a single system or are unfamiliar with the mass casualty triage system in their state (because this function is located in another office.) One state, Georgia, currently uses MUCC although several other states are reportedly pilot testing the guideline (Fig. 19.)
7. Federal Funding/Grant Support

In the absence of federal appropriations to support trauma systems planning and development, states have struggled to implement and maintain essential systems. In 2010, thirty six percent of respondents reported they received no federal monies from any source. In 2015, thirty nine percent of respondents suffered serious decline in the level of federal funding. Figure 20 illustrates the decline of federal funding opportunities and the shift to the reliance on state-generated revenues to support trauma care. Examples include fines and fees on moving violations, fees on motor vehicle registrations, fees on license plates, fees on driver’s license renewals, taxes on cigarette sales, fees from criminal penalties, and funds from general revenues although state trauma programs are competing within their own states for the distribution of these funds.

8. Key Data

- 82% of respondents (n=33) indicated their state has enabling legislation or rules to designate trauma centers.
- 23% of respondents (n=8), only 16 percent of all states, have legislative authority to limit the number of trauma centers.
- 79% of respondents (n=31) are administratively located within the state health department.
- 15% of respondents (n=6) were housed within another state agency.
- 2 respondents were located within a state hospital association or foundation.
- 64% of respondents (n=25) were located within the state EMS office.
- 31% of respondents (n=12) “work collaboratively with the state EMS office but do not administratively report there.”
- 2 respondents indicated they are totally separate from the EMS office and interface with multiple state agencies.
- The average number of FTE state trauma program staff was 5, inclusive of an administrative lead, general program staff, facility designation, data registries, an epidemiologist, and persons that fulfill multiple job functions.
- 39% of respondents (n=16) utilized the MTSPE document (HRSA, 2006) to develop their state trauma plan while 34% of respondents (n=14) have used the BIS Assessment Tool.
- 19% of respondents (n=8) utilized ACSCOT Regional Trauma Systems Guide (2008) to develop state trauma plans.
II. State Trauma Programs

- 27% of respondents (n=11) have a “hybrid” state trauma plan developed from multiple resources.
- 17% of respondents (n=7) do not currently have a state trauma plan.
- 95% of respondents (n=39) indicate the presence of a state trauma program.
- 51% of respondents (n=21) indicate their state has a STEMI regionalization program.
- 56% of respondents (n=23) indicate their state has a stroke regionalization program.
- 9% of respondents (n=4) indicate their state manages other regionalization programs (such as pediatrics).
- 67% of respondents (n=27) indicate involvement in statewide trauma prevention activities, while 48% (n=20) are involved in public information and education activities beyond injury prevention.
- 31% of respondents (n=13) have an identified role in the state disaster response plan.
- 22% of respondents (n=9) have their own Mass Casualty Incident Plan.
- 51% of respondents (n=21) use START as the uniform disaster triage guideline used in their state.
- 5% of respondents (n=2) use SALT as the uniform disaster triage guideline used in their state.
- 23% of respondents (n=9) do not have a uniform disaster triage guideline used in their state.
- 46% of respondents (n=19) did not receive federal or outside funding for state trauma program administration.
III. Trauma Center Designation Process in the States

This section addresses the findings from the following assessment questions (Click HERE to skip questions and go to narrative):

Q21 What levels (or state nomenclature) of trauma centers does your state recognize?
- Level 1
- Level 2
- Level 3
- Level 4
- Level 5
- None

Q25 To what extent are the criteria for your trauma centers based on the current American College of Surgeons/Committee on Trauma criteria?
- Completely
- Partially
- Not at all
- Other (please explain)

Q26 How are site visits for the Trauma Center verification for designation purposes conducted in your state? (Please select BEST response)
- Our State exclusively utilizes the Verification, Review, and Consultation Program (VRC) conducted by the American College of Surgeons to support state designation of Trauma Centers
- Our State conducts its own site survey and review process of Trauma Centers in our state
- Trauma Center designation is accomplished through a partnership between the state and VRC program (state representatives participate in all reviews and site visits conducted by the VRC)
- Our State does not verify or designate Trauma Centers
- Other

Q27 If your state conducts site visits, what sort of team is used to conduct the trauma center site reviews?
- ACS Team
- State Team
- Combination of ACS/State representatives
- Our state does not conduct site visits for Trauma Centers
- Other (please explain)

Q28 What is the period of time (in years) for which an INITIAL trauma center designation is valid? (Please EXCLUDE probationary or provisional status)
- One year
- Two years
- Three years
- Four years
- Five years
- More than 5 years
- Level does not apply to our state

Q29 Is a site review required for the REVERIFICATION of designated trauma centers in your state?
- Yes
- No
- Level does not apply to our state

Q30 What other trauma related specialty centers exist in your state?
• Burn
• Hand/Microsurgery
• Neurotrauma (includes head and/or spine)
• Vascular
• Eye
• None
• Other (please specify)

Q31 If your State conducts its own review and site survey, where do your team members come from? Please choose BEST response.)
• All site survey team members are State employees.
• Our site survey team is primarily comprised of experts from out of state
• Our site survey is conducted via "peer reviewers" or experts from within the state
• Our state doesn't conduct trauma center verification site visits

Q32 Who routinely comprises your state trauma center verification team (Please check all that apply.)
• Neurosurgeon
• Trauma Surgeon
• Orthopedic Surgeon
• Anesthesiologist
• ED Physician
• Trauma Program Manager/Director
• Trauma Registrar
• State Program Representative
• Other

Q33 Who covers the logistics and travel expenses related to the verification (site survey visit) trauma center designation process in your state?
• State funds are used to cover expenses related to the designation of its Trauma Centers (such as taxes or fees)
• The hospital/facility is responsible for covering all designated related expenses
• Our state doesn't conduct Trauma Center verification surveys or site visits

1. State Designation and Standards Verification
The American Trauma Society (ATS) appropriately defines Trauma Center designation as a process outlined and developed at the state specific level. The state identifies unique criteria in which to categorize Trauma Centers. These categories vary from state to state and are typically outlined through legislative or regulatory authority.

Trauma Center verification is an evaluation process provided by the state and/or the American College of Surgeons (ACS) to evaluate and improve trauma care. The ACS does not designate trauma centers; instead, it verifies voluntary compliance with its standards—“Resources for Optimal Care of the Injured Patient”.

Distribution of State Designated Trauma Centers in the Continental US. Source: American Trauma Society (2016)
Green- Level 1
Red- Level 2
Black – Level 3
Silver- Level 4
Orange – Level 5
Blue – Pediatric Level 1 or 2

III. Trauma Center Designation Process in the States
State trauma systems evolved with little outside influence other than resource documents and intermittent grant support from the federal government. As a result, the state systems have a heterogeneous approach to trauma system design, development and administration. Not all states formally recognize trauma centers, and of those that do, not all recognize each level of trauma center. The concept of an inclusive trauma care systems promotes regionalization of trauma care and of the forty-one respondents, a palpable shift to greater inclusion of Levels III-V has taken place since 2010. (Fig. 21.) The criteria used to evaluate the trauma centers vary among states and even within states between levels of trauma center. The American College of Surgeons Committee on Trauma (ACSCOT) criteria for trauma centers is used exclusively by only twenty one percent (n=8) of respondents, a decrease of twenty percent since 2010. However, this shift was likely offset by a twenty five percent increase of respondents that partially use the ACSCOT criteria since 2010 or seventy one percent (n=27). Criteria other than ACSCOT are used by eight percent of respondents (Fig. 22.)
III. Trauma Center Designation Process in the States

Site visits to verify or validate compliance with standards to recognize trauma center status appears to be a requirement of ninety percent of the respondents (n=37). Eleven percent of respondents (n=4) exclusively uses the ACSCOT Verification, Review, and Consultation (VRC) Program to support state designation of trauma centers. Thirty two percent of respondents (n=12) conduct their own site survey and review process to recognize trauma centers. Twenty one percent of respondents (n=8) accomplish designation through a partnership between the state and VRC program. Thirty four percent of respondents (n=13) use a hybrid process to designate trauma centers, for example, the VRC may be used for Level I, Level II, and on occasion, Level III Trauma Centers and the state accomplishes the designation process for levels III-V. Of the hybrid group, four respondents will accept either the VRC or state review process for recognition. One state respondent has not yet completed the rules to determine the state recognition process (Fig. 23.) Even when the state relies on the VRC for verification, the composition of the site survey team remains a partnership between the ACSCOT and the state (Fig. 24.) When state teams are used exclusively to verify compliance, the majority of respondents indicate that peer reviewers/experts from within the state are used and out-of-state participants are used to a lesser degree (Fig. 25.) An array of expert panelists participates in the surveys led most commonly by a trauma surgeon. Trauma Program Managers, a State Representative (from the state trauma program), and emergency medicine physicians round out the team. Other experts are included on a case-by-case basis (Fig. 26.) The composition of the site review teams varies between and with states, sometimes depending on the level of trauma center being reviewed. Use of ACSCOT site review teams (at least for certain reviews) is mentioned by 7 states (decreased by seven percent from 2010.) The use of state review teams (at least for certain reviews) was indicated by 22 states (increase of fourteen percent from 2010.) The use of a combination of teams was indicated by 6 states (decrease of eight present from 2010); and 6 states indicated use of other types of teams or strategies for site review (no change from 2010.)

The designation periods range from one to five years, with an average mode of three years for designation (Fig. 27.) The logistics and travel expenses related to the verification (site survey visit) are borne by the state in fifty five percent of respondents (n=20). Thirty nine percent of respondents (n=14) indicate the expenses become the responsibility of the facility being assessed. (Fig. 28.) Of the 37 states that require site review for trauma center recognition ninety five percent also require re-review for renewal of the trauma center status. (Fig. 29.) While the assessment included other types of trauma related specialty centers recognized by states (such as burns and neurotrauma), the methodology involving recognition is beyond the scope of this monograph.
2. Key Data

- 21% of respondents (n=8) use ACS criteria/standards exclusively for state trauma center designation.
- 71% of respondents (n=25) use a combination of state and ACS criteria for trauma center designation.
- 8% of respondents (n=3) are in the process of developing/revising criteria for state trauma center designation.
- 11% of respondents (n=4) indicate their state exclusively utilizes the ACS VRC Program to support state designation of trauma centers.
- 32% of respondents (n=12) indicate their state conducts its own site survey and state-based review for trauma centers in their state.
- 20% of respondents (n=7) indicate that trauma center designation is accomplished through a partnership between the state and ACS VRC program.
- 1 respondent indicated their state does not verify or designate trauma centers.
- 34% of respondents (n=13) use the VRC for level 1-3 centers only and state processes for levels 3-5.
IV. Trauma Centers

This section addresses the findings from the following assessment questions (Click HERE to skip questions and go to narrative):

Q23 What is the total number of each level of ADULT Trauma Centers that currently exist in your state? (Numerical data only, if none, use 0)

- Level 1
- Level 2
- Level 3
- Level 4
- Level 5

Q24 What is the total number of each level of PEDIATRIC Trauma Centers that currently exist in your state? (Numerical data only, if none, use 0)

- Level 1
- Level 2
- Level 3
- Other (including combined adult/peds)

1. Types of Trauma Centers in an Inclusive System

Trauma Centers are referred to in terms of “levels” (ie. Level I, II, III, IV or V.) Levels refer to trauma center capacity and resources to care for patients, in other words, Level I is the highest level of capability while Level V provides the lowest capability. Facilities can also be designated/verified as adult and/or pediatric trauma centers. It is not uncommon for facilities to have different designations for each group (ie. a trauma center may be a Level I adult facility and also a Level II pediatric facility). NAEMSO concurs with the common descriptions published by the American Trauma Society to outline various criteria used in designating/verifying trauma centers illustrated below.

**Level I** - Level I Trauma Center is a comprehensive regional resource that is a tertiary care facility central to the trauma system. A Level I Trauma Center is capable of providing total care for every aspect of injury – from prevention through rehabilitation.

Elements of Level I Trauma Centers Include:

- 24-hour in-house coverage by general surgeons, and prompt availability of care in specialties such as orthopedic surgery, neurosurgery, anesthesiology, emergency medicine, radiology, internal medicine, plastic surgery, oral and maxillofacial, pediatric and critical care.
- Referral resource for communities in nearby regions.
- Provides leadership in prevention, public education to surrounding communities.
- Provides continuing education of the trauma team members.
- Incorporates a comprehensive quality assessment program.
- Operates an organized teaching and research effort to help direct new innovations in trauma care.
- Program for substance abuse screening and patient intervention.
- Meets minimum requirement for annual volume of severely injured patients.
**Level II** - A Level II Trauma Center is able to initiate definitive care for all injured patients.

Elements of Level II Trauma Centers Include:

- 24-hour immediate coverage by general surgeons, as well as coverage by the specialties of orthopedic surgery, neurosurgery, anesthesiology, emergency medicine, radiology and critical care.
- Tertiary care needs such as cardiac surgery, hemodialysis and microvascular surgery may be referred to a Level I Trauma Center.
- Provides trauma prevention and to continuing education programs for staff.
- Incorporates a comprehensive quality assessment program.

**Level III** - A Level III Trauma Center has demonstrated an ability to provide prompt assessment, resuscitation, surgery, intensive care and stabilization of injured patients and emergency operations.

Elements of Level III Trauma Centers Include:

- 24-hour immediate coverage by emergency medicine physicians and the prompt availability of general surgeons and anesthesiologists.
- Incorporates a comprehensive quality assessment program
- Has developed transfer agreements for patients requiring more comprehensive care at a Level I or Level II Trauma Center.
- Provides back-up care for rural and community hospitals.
- Offers continued education of the nursing and allied health personnel or the trauma team.
- Involved with prevention efforts and must have an active outreach program for its referring communities.

**Level IV**

A Level IV Trauma Center has demonstrated an ability to provide advanced trauma life support (ATLS) prior to transfer of patients to a higher level trauma center. It provides evaluation, stabilization, and diagnostic capabilities for injured patients.

Elements of Level IV Trauma Centers Include:

- Basic emergency department facilities to implement ATLS protocols and 24-hour laboratory coverage. Available trauma nurse(s) and physicians available upon patient arrival.
- May provide surgery and critical-care services if available.
- Has developed transfer agreements for patients requiring more comprehensive care at a Level I or Level II Trauma Center.
- Incorporates a comprehensive quality assessment program
- Involved with prevention efforts and must have an active outreach program for its referring communities.

**Level V** - A Level V Trauma Center provides initial evaluation, stabilization and diagnostic capabilities and prepares patients for transfer to higher levels of care.

Elements of Level V Trauma Centers Include:
IV. Trauma Centers

- Basic emergency department facilities to implement ATLS protocols
- Available trauma nurse(s) and physicians available upon patient arrival.
- After-hours activation protocols if facility is not open 24-hours a day.
- May provide surgery and critical-care services if available.
- Has developed transfer agreements for patients requiring more comprehensive care at a Level I through III trauma centers.

2. Key Data

Levels of Trauma Centers recognized by the state:

- 89% of respondents (n=34) recognize Level I Trauma Centers
  (Adult average 5; total reported 169)
  (Pediatric average 1; total 49)
  *Decreased variance from 2010 is – 16%

- 94% of respondents (n=36) recognize Level II Trauma Centers
  (Adult average 7; total reported 264) (Pediatric average 1; total 27)
  *Net variance reported from 2010 is 0%

- 89% of respondents (n=34) recognize Level III Trauma Centers
  (Adult average 10; total reported 369) (Pediatric average 1; total 11)
  *Increased variance reported from 2010 is +12%

- 63% of respondents (n=24) recognize Level IV Trauma Centers
  (Adult average 21; total reported 698) (No pediatric trauma centers at this level)
  *Increased variance reported from 2010 is +63%

- 23% of respondents (n=8) recognize Level V Trauma Centers
  (Adult average 5; total reported 124) (No pediatric trauma centers at this level)
*Increased variance reported from 2010 is +117%

- In spite of a net loss in the Level I category, there has been a 27 percent increase in trauma centers overall since 2010.
- 38 total combined adult/pediatric trauma centers were reported in 2015.
V. Medical Direction and Use of Trauma Protocols

This section addresses the findings from the following assessment questions (Click HERE to skip questions and go to narrative):

Q52 Who provides medical direction for your state trauma system?
1. State EMS Medical Director
2. State Trauma Medical Director
3. Our State EMS Medical Director and State Trauma Medical Director share responsibilities
4. We do not have a medical oversight position for trauma in our state
5. If Other (please specify)

Q53 In what capacity does your state trauma medical director serve?
1. Full time
2. Part time
3. Volunteer
4. Contractual
5. Our state does not have a state trauma medical director
6. Other (please explain)

Q54 Which BEST describes the role of your state's ACS-COT chair in your trauma system?
1. Chairs state advisory group
2. Serves on state advisory group or EMS Board
3. Serves as state trauma medical director
4. If Other (please specify)

Q55 Are the CDC Field Trauma Triage Guidelines (version 2011) in use in your state?
1. Yes, without modification
2. Yes, with modifications
3. No, other field triage guideline is used (please specify below)
4. No, not at all
5. Other (please specify)

Q56 Please indicate the level of control for written protocols or guidelines required for treatment, triage, transport, and tracking of trauma patients (for each item, please check all that apply)
1. Trauma patient treatment
2. Trauma patient triage
3. Trauma patient transfer
4. Trauma patient tracking
5. Other state or regional guideine that is not based on CDC guidelines

Q57 Does your state trauma triage protocol enable EMS providers to bypass hospitals that are non-designated to receive trauma and transport directly to a trauma center?
1. Yes
2. No
3. Our state does not have a state trauma triage protocol

Q58 Are state trauma triage protocols tracked for compliance?
1. Yes
2. No
3. We do not have state trauma triage protocols in our state

1. Medical Directors and State Trauma Committee
The State Trauma Medical Director provides oversight of the medical aspects of leadership, coordination, evaluation, system quality management, and research in order to assure the best possible patient outcomes. Twenty one
percent of respondents (n=8) indicate the State EMS Medical Director serves as the State Trauma Medical Director. Thirteen percent of respondents (n=5) indicate they have a separate State Medical Director for Trauma. Sixteen percent of respondents (n=6) indicate the State EMS Medical Director and State Trauma Medical Director have shared responsibilities. Thirty four percent of respondents (n=13) indicate their state does not have a medical oversight position for trauma. Only nine percent of respondents reported that the State Trauma Medical Director is a full time position at the state level and fifteen percent of respondents indicate their State Trauma Medical Director serves as a volunteer (non-compensated) in this capacity.

The American College of Surgeons Committee on Trauma (ACSCOT) has indisputably served in a leadership role in the advancement of trauma care and the development of trauma care systems. Each state chapter has an ACSCOT Chair who has been an important resource even for states that may not have a designated trauma medical director.

The ACSCOT chair leads the state trauma advisory committee in 10 states, serves on the advisory committee as a member in 13 states, serves as the state trauma medical director in 1 state, and serves in another capacity in 18 states (Fig. 35.)

2. Use of Triage, Treatment, and Transfer Protocols

Triage is the sorting and classification of patients by severity of injury. Triage protocols take into account certain physiologic parameters (such as vital signs and level of consciousness), nature and extent of anatomical injury, the
presence of co-morbid factors likely to impact survival, and the mechanism of injury to estimate potential injury severity sustained from the traumatic event.

Treatment protocols detail the specific interventions to be followed by prehospital EMS in the field management of injured patients. Treatment protocols are intended to expedite patient treatment, allowing emergency care to begin before contact is established with a medical control physician, and sometimes in lieu of contact with a medical control physician.

Trauma Patient Transfer Protocols address the movement of certain injured patients from one type of facility to another. Some severely injured patients may be taken initially to a hospital only for initial treatment and stabilization, or the patient may be diagnosed with a more serious injury after initial medical assessment, necessitating transfer to a higher-level trauma center with requisite specialty expertise. The intent of transfer protocols is sometimes achieved with other instruments such as voluntary interfacility agreements or through regulatory language.

NASEMSO evaluated the level of control for written protocols or guidelines required for treatment, triage, transport and tracking of trauma patients. Of the responding states, the use of a statewide written protocol for trauma patient triage has decreased from 2010 by ten percent to sixty one percent (n=23) and it appears that the authority has started to shift to regional (eighteen percent or n= 7) and local (thirty seven percent or n=14) authorities. The 2011 CDC Guidelines for Field Triage of Injured Patients (or a modified version) is in use by eighty four percent of respondents (n=32), an increase of nine percent from 2010. Of these respondents, the frequency that state, regional, or local authorities modify the CDC Field Triage Guidelines is fifty-eight percent (n=22.) Twenty six percent of respondents (n=10) use the CDC Guidelines without modifying them. Five respondents report a statewide protocol in place that is not based on CDC Guidelines or a lack of a trauma triage protocols altogether.

State trauma triage protocols are tracked for compliance by thirty seven percent of respondents (n=14). In other words, fifty percent of respondents (n=19) do not monitor trauma triage protocols for compliance. Thirteen percent of respondents (n=5) indicate a lack of trauma triage protocols in the state.

Eighty seven percent of respondents (n=32) indicate that state, regional, and local trauma triage protocols enable EMS to transport patients directly to a trauma center and bypass facilities that are not designated as trauma centers.

Forty one percent of respondents (n=15) indicate that trauma patient treatment protocols are in place at the statewide level, eleven percent (n=4) at the regional level, and fifty one percent (n=19) at the local level. These findings are similar to 2010 data.

Similarly, forty three percent of respondents (n=16) indicate the presence of a statewide trauma patient transfer protocol. Regional transfer protocols were noted by twenty four percent of respondents (n=9) and forty six percent of respondents (n=17) indicate that local transfer protocols are in place.
V. Medical Direction and Use of Trauma Protocols

3. Key Data

- 21% of respondents (n=8) indicate the State EMS Medical Director serves as the State Trauma Medical Director.
- 13% of respondents (n=5) indicate they have a separate State Medical Director for Trauma.
- 16% of respondents (n=6) indicate the State EMS Medical Director and State Trauma Medical Director have shared responsibilities.
- 34% of respondents (n=13) indicate their state does not have a medical oversight position for trauma.
- 8% of respondents (n=3) indicate the State Trauma Medical Director is a full time position.
- 13% of respondents (n=5) indicate the State Trauma Medical Director is a part time position.
- 13% of respondents (n=5) indicate the State Trauma Medical Director is a volunteer position.
- 16% of respondents (n=6) indicate the State Trauma Medical Director is a contracted position.
- 39% of respondents (n=15) indicate their state does not have a State Trauma Medical Director.
- 26% of respondents (n=10) describe the primary role of the state’s ASC-COT Chair as chair of the state trauma advisory group.
- 34% of respondents (n=13) indicate the state COT chair serves on the state advisory group or Board as a member (not chair)
- 3% of respondents (n=1) indicate the state COT chair serves as the State Trauma Medical Director.
- 47% of respondents (n=18) offered additional comments related to the state COT chair including resource but no official position in state trauma system, ad hoc/advisory role, regional level involvement, involved in injury prevention and performance improvement, 2 respondents indicated the state COT chair is not active, and 2 respondents were not aware their state had a state COT chair.
- 26% of respondents (n=10) use the CDC Field Trauma Triage Guidelines (2011) without modification as the approved trauma triage protocol in their state.
- 48% of respondents (n=22) use the CDC Field Trauma Triage Guidelines (2011) for input but have modified them for the state.
V. Medical Direction and Use of Trauma Protocols

- 3% of respondents (n=1) indicate that triage decisions are handled at the local level.
- 3% of respondents (n=1) indicate there is no trauma triage guideline in use in their state.
- 11% of respondents (n=4) provided comments that indicate the CDC Guidelines were used as a reference but were not implemented in the state.
- Overall, states maintain responsibility for trauma patient triage and trauma patient tracking, however regional/local authorities maintain accountability for decisions related to trauma patient treatment and interfacility transfer of trauma patients.
- 84% of respondents (n=32) enable EMS providers to bypass non-designated hospitals and transport patients directly to a trauma center by protocol.
- 37% of respondents (n=14) monitor state trauma triage protocols for compliance.
- 50% of respondents (n=19) do not monitor state trauma triage protocols for compliance.
- 13% of respondents (n=5) lack a state trauma triage protocol.
VI. Data and Performance

This section addresses the findings from the following assessment questions (Click HERE to skip questions and go to narrative):

Q16 Does your state have a state performance improvement plan or guide?
- Yes, we have a "standalone" performance improvement plan or guide just for trauma
- Yes, we have a trauma performance improvement plan or guide but it is integrated with EMS, preparedness, or other plan
- No, we do not have a statewide performance improvement plan or guide

Q17 Please list your top three state trauma performance improvement (PI) measures.

Q43 Does your state have a state Trauma Registry?
- Yes, participation is mandatory
- Yes, but participation is voluntary
- No, our state does not have a state Trauma Registry

Q44 If your state requires participation in the state Trauma Registry, who is required to submit the data?
- All acute care hospitals
- Trauma Centers only
- Our state does not have or does not require participation in the state trauma registry
- If Other (please explain)

Q45 What software is used for the state Trauma Registry?
- Digital Innovations, Inc (NTRACS or Collector)
- ImageTrend, Inc
- Clinical Data Management (Trauma Base)
- Lancet Technology (Trauma One)
- Our state does not have a state Trauma Registry
- If Other (please specify)

Q46 Is your Trauma Registry vendor compliant with the National Trauma Data Bank (NTDB) standards?
- Yes
- No
- Our state does not have a state Trauma Registry

Q47 Who performs data analysis of your state Trauma Registry?
- State staff
- Software vendor
- Contractor
- We do not perform data analysis of our state Trauma Registry
- Our state does not have a state Trauma Registry
- If Other (please specify)

Q48 Are any special reports generated using Trauma Registry data for any of the following target audiences: (please check all that apply)
- Participating hospitals
- Legislature
- Federal agency
- EMS
- General public
- Our state does not have a state Trauma Registry
- If Other (please specify)

Q49 What is the frequency of reporting to the state Trauma Registry?
- At least monthly
VI. Data and Performance

- At least quarterly
- At least semiannually
- At least annually
- Time frame related to patient discharge
- Our state does not have a state Trauma Registry

Q50 Is Trauma Registry information integrated (linked) with prehospital data reporting?
- Yes
- No
- Our state does not have a state Trauma Registry

Q51 What software is used for the EMS data registry at the state level?
- ImageTrend
- Digital Innovations
- If Other (please specify)

1. State Trauma Registries

The trauma registry is a repository of information (usually computerized) about the treatment, diagnosis and outcomes of trauma patients. The input instrument is usually a data form that contains prescribed fields allowing the input of standardized types of information about seriously injured patients. The crux of the registry though is the data definitions, inclusion criteria, and reporting requirements. In 2010, states reported that only trauma centers were required to submit data. In 2015, of thirty seven respondents that reported the existence of a state trauma registry, forty seven percent (n=18) indicate that only trauma centers are required to submit data to the state trauma registry. Thirty four percent of respondents (n=13) indicate that all acute care hospitals are now required to submit data to state trauma registry.

The value of aggregating and analyzing information is largely dependent on how the information is used. Performance improvement is the use of properly analyzed data to evaluate processes and improve trauma patient outcomes. Performance can be measured in several different ways. In general, when evaluating the performance of a trauma care system, considerations relate to: efficiency parameters that capture how quickly the prescribed procedures are done; and effectiveness parameters that capture the outcomes. Performance measures can be devised for each link in the chain of care if the pertinent data are available to support assessment. Forty one percent of respondents (n=16) have a state performance improvement plan or guide, five percent of respondents (n=2) have integrated trauma performance measures into the state EMS, preparedness, or other plan, and fifty four percent (n=21) do not have specific performance improvement programs in place (Fig. 40.) Eighty nine percent
(n=34) of respondents indicate their trauma registry is compliant with National Trauma Data Bank (NTDB) standards. Eight percent (n=3) are using “home grown” systems that are not NTDB compliant. Consistent with 2010 findings, state staff is expected to perform data analysis. Eighty four percent (n=32) of respondents indicate that state staff performs data analysis, ten percent (n=4) performs data analysis through contracted staff, and five percent of respondents (n=2) do not perform data analysis of the state trauma registry. New findings in 2015 indicate that five percent of respondents (n=2) rely on a software vendor to perform data analysis.

Respondents were asked to list their top state trauma Performance Improvement (PI) measures. The responses were grouped into themes as identified below:

#1 Highest- trauma deaths, EMS trauma triage (over/under), and trauma transfers to a higher level of care.
#2 Moderate-EMS protocol usage, trauma surgeon arrival, trauma transfers, trauma deaths.
#3 Lowest-EMS trauma triage (over/under), trauma activation, response times for trauma surgeon, neurosurgeon, transfer and complications and trauma deaths.
#4-EMS protocols and response times for EMS scene time, diagnosis, OR, orthopedic surgeon, ED length of stay and ED to ICU times.

2. Interface with Prehospital Data
Of the thirty eight states using computerized registry platforms, forty two percent (n=16) integrate trauma registry information with the prehospital data system (Fig. 41), an increase of nine percent from 2010. A six percent increase in the use of commercial software systems specifically for trauma is reported from 2010.
VI. Data and Performance

Special reports using trauma data are often developed for various target audiences to improve awareness of the trauma system. Special reports are produced for participating hospitals in 29 states; special reports for the legislature are produced in 19 states; and special reports for other target audiences are produced in 4 states. This information is similar to data collected in 2010. Utilization of software vendors for trauma and EMS is illustrated in Figure 42.

3. Key Data

43% of respondents (n=34) indicate the state has a statewide Trauma Registry and that participation is mandatory.
8% of respondents (n=3) indicate the state has a statewide Trauma Registry and that participation is voluntary.
3% of respondents (n=1) indicate the state does not have a statewide Trauma Registry.
34% of respondents (n=13) indicate that all acute care hospitals are required to submit data to the state trauma registry.
47% of respondents (n=18) indicate that only trauma centers are required to submit data to the state trauma registry.
47% of respondents (n=18) use Digital Innovations (NTRACS or Collector) software for the state trauma registry.
29% of respondents (n=11) use ImageTrend software for the state trauma registry.
5% of respondents (n=2) use Clinical Data Management (Trauma Base) software for the state trauma registry.
5% of respondents (n=2) use Lancet Technology (Trauma One) software for the state trauma registry.
11% of respondents (n=4) mention the use of Dunn (1), Maven (1), and “homegrown” (2) products for the state trauma registry.
89% of respondents (n=34) report their trauma registry vendor is compliant with NTDB standards.
8% of respondents (n=3) are non-NTDB compliant.
84% of respondents (n=32) use state staff to analyze trauma data and trends within the state.
5% of respondents (n=2) rely on software vendors to analyze state data and trends.
11% of respondents (n=4) hire contractors to analyze state data and trends.
5% of respondents (n=2) do not analyze trauma data and trends.
13% of respondents (n=5) indicate that data analysis is conducted at the facility or local level.
76% of respondents (n=29) report that participating hospitals are the biggest users of trauma data, followed by state
legislatures and EMS. Researchers and the general public comprise 43% of requests for data.

55% of respondents (n=21) required data submission on a quarterly basis.

61% of respondents (n=23) indicate that trauma registry information is not linked with prehospital data reporting.

37% of respondents (n=14) ensure linkages between EMS and trauma reporting systems.

63% of respondents (n=24) use ImageTrend software for EMS data collection

36% of respondents (n=14) use a range of EMS software, including several “homegrown” databases.
VII. Educational Requirements

This section addresses the findings from the following assessment questions (Click HERE to skip questions and go to narrative):

Q40 Which educational offerings does your state require for trauma center administrative or non-clinical staff? (Please check all that apply)
- ATS Trauma Program Manager Course (TPM)
- ATS Trauma Registrar Course (TRC)
- ACS Rural Trauma Team Development Course (RTTDC)
- STN Trauma Outcomes and Performance Improvement Course (TOPIC)
- TCAA Trauma Medical Directors Course
- TCAA Finance and Business Planning Course
- Other (please specify below)
- Our state does not have educational requirements for trauma center administrative or non-clinical personnel

Q41 Which educational offerings does your state require for trauma center clinical personnel? (Please check all that apply)
- Advanced Burn Life Support (ABLS)
- Advanced Pediatric Life Support (APLS or PALS)
- Advanced Trauma Life Support (ATLS)
- Advanced Trauma Care for Nurses (ATCN)
- Basic Trauma Life Support (BTLS)
- Course in Advanced Trauma Nursing (CATN)
- Prehospital Trauma Life Support (PHTLS)
- Trauma Nursing Core Course (TNCC)
- Other (please specify below)
- Our state does not have trauma specific education requirements for trauma center clinical personnel

Q42 If your state requires trauma education, does it provide any financial support or other incentives for these programs?
- Yes
- No
- Trauma specific education is not a requirement in our state

1. Required Education for Administrative and Non-Clinical Staff
Training and professional development of the trauma workforce is critical to a viable trauma system. There are several administrative and clinically oriented programs for trauma professionals including physicians, program directors, nurses, trauma registrars, and prehospital emergency medical personnel available from various professional organizations, including the American College of Surgeons (ACS), the American Trauma Society (ATS), the Emergency Nurses Association (ENA), the National Association of EMTs (NAEMT), the Society of Trauma Nurses (STN), and the Trauma Center Association of America (TCAA). The assessment did not seek to make any recommendations related to these programs, the purpose of the assessment was merely to estimate the use of mandatory education in the areas of trauma system planning and development.
2. Required Education for Trauma Center Clinical Personnel

While continuing education (CE) and/or periodic re-examination have been utilized by states in the professional licensure and relicensure process and widely accepted in EMS as a method of maintaining and enhancing individual competence, NASEMSO recognizes that there are multiple methods by which an individual may demonstrate continuing competence. We have observed in related studies that professional competency models support the need for individual responsibility through self-assessment, development and implementation of a personal learning plan and periodic reassessment to achieve the goals of continuing competence. NASEMSO supports the state oversight role and coordination with medical directors, EMS agencies, and trauma centers to ensure that these goals are adequately accomplished and documented. In 2015, NASEMSO conducted a competency assessment summit in conjunction with its Education and Professional Standards Council to discuss the topic of clinical competency in the context of the state relicensure process. The findings and recommendations of the summit may be useful in the state trauma center verification process. The resource is available at http://nasemso.org/EMSEducationImplementationPlanning/documents/Continuing-Competence-White-Paper-Apr2015.pdf.

3. Key Data

85% of respondents (n=23) do not have educational requirements for trauma center administrative or non-clinical personnel for designation purposes.

84% of respondents (n=21) require the Advanced Trauma Life Support Course (ATLS) for physicians.

75% of respondents (n=12) require the Trauma Nursing Core Course for nurses working in trauma centers.

37% of respondents (n=14) offer state assistance with costs for conducting trauma courses.

47% of respondents (n=18) do not offer state assistance with costs for conducting trauma courses.

16% of respondents (n=6) indicate that trauma specific education is not a requirement in the state.
VIII. Strengths, Weaknesses, Opportunities, and Threats (SWOT) Analysis

As a result of the 2015 assessment, NASEMSO provides the following summary regarding the status of statewide trauma system planning and development of the past decade:

<table>
<thead>
<tr>
<th>STRENGTHS</th>
<th>WEAKNESSES</th>
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<tbody>
<tr>
<td>• State oversight of trauma systems</td>
<td>• Lack of an identified/coordinating role for the state trauma program in the state disaster response plan</td>
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<tr>
<td>• State trauma program administratively affiliated with the State Health Department</td>
<td>• MCI plans that do not integrate trauma centers into response planning efforts</td>
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<tr>
<td>• Close alignment of trauma and EMS programs at the state level</td>
<td>• Lack of consistency for mandatory trauma education</td>
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<td>• Legislative authority to regulate/designate trauma centers</td>
<td>• Medical direction for the state trauma system</td>
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<tr>
<td>• State trauma plans based on national guidelines</td>
<td>• Lack of statewide/trauma center performance improvement plan</td>
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<td>• Statewide/regional stakeholder oversight of the trauma system</td>
<td>• Lack of injury rehabilitation expertise on state trauma committees</td>
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<td>• Trauma center verification and designation processes identified</td>
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<tr>
<td>• State trauma registry capabilities</td>
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<tr>
<td>• Reporting based on state trauma registry data</td>
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<td>• National Trauma Data Bank compliance by trauma centers</td>
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<td>• State participation in injury prevention activities (i.e. &quot;Toward Zero Deaths&quot;)</td>
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<td>• State ACSCOT chair involvement in the state trauma system</td>
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<td>• State use of CDC Field Trauma Guidelines (version 2011)</td>
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<td>• Trauma triage protocols that enable EMS personnel to bypass directly to a trauma center</td>
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<table>
<thead>
<tr>
<th>OPPORTUNITIES</th>
<th>THREATS</th>
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<tr>
<td>• Enhanced injury prevention activities based on state patterns/trends</td>
<td>• Lack of financial support for state trauma programs at the federal level</td>
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<td>• Integrated prehospital data reporting</td>
<td>• Increasing responsibilities for the state trauma manager</td>
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<td>• Monitoring of state trauma triage protocols for compliance</td>
<td>• Lack of legislative authority to limit the number/location of trauma centers</td>
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<td>• Trauma registries for all acute care hospitals</td>
<td>• Lack of financial support for trauma education programs</td>
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<td>• Trauma registry data analysis performed by the state</td>
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<td>• State coordination of time sensitive conditions/systems</td>
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<tr>
<td>• Standardization of rehabilitation interface with trauma data registries</td>
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<td>• State trauma program Involvement in public information &amp; education beyond injury prevention</td>
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<tr>
<td>• Use of social media</td>
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<tr>
<td>• Educational requirements and offerings for trauma administrative and clinical staffs</td>
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## IX. Index of State Trauma Program -Web Sites

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NASEMSO 2016 Trauma Monograph
Contact Information

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Trends in External Causes of Death, Kansas, 2000-2014

Research Summary

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http://www.kdheks.gov/bephi
September 2016
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Data for this report were collected by:

Office of Vital Statistics
Kay Haug, Director

Our Vision – Healthy Kansans living in safe and sustainable environments

Our Mission – To protect and improve the health and environment of all Kansans
Executive Summary

This report presents statistics on Kansas resident deaths and death rates due to selected external causes of death during the 2000-2014 period. Disparities in mortality rates due to external causes are analyzed using several demographic categories (sex, geographic region, and population group) to segment the population.

Analysis is limited to the four (out of 21) most common external causes of death: motor vehicle traffic incidents, firearms incidents, drug poisonings, and falls. In the most recent 3-year period (2012-2014) these four causes accounted for over seventy percent (71.5%) of all deaths due to external causes.

Data in this report are taken from death certificates of Kansas residents included in the vital records database maintained by the Office of Vital Statistics (OVS), Kansas Department of Health and Environment (KDHE). This database also includes death data shared by other states for Kansas residents who died out of state.

Overall, the number of Kansas residents who died due to all external causes rose from 4,707 in the 2000-2002 period to 5,866 in the 2012-2014 period. The corresponding age-adjusted death rates rose from 56.9 per 100,000 population in the 2000-2002 period to 65.0 per 100,000 population in the 2012-2014 period.

From the 2000-2002 period to the 2012-2014 period, Kansas resident death rates due to the four most common external causes changed as follows:

- motor vehicle traffic incident death rates decreased by 31.5 percent, from 18.1 per 100,000 population to 12.4 per 100,000 population;
- firearms incident death rates increased by 14.4 percent, from 10.4 per 100,000 population to 11.9 per 100,000 population;
- drug poisoning death rates increased by 121.6 percent, from 5.1 per 100,000 population to 11.3 per 100,000 population; and
- fall death rates increased by 81.7 percent, from 6.0 per 100,000 population to 10.9 per 100,000 population.

While motor vehicle traffic incidents are still the leading external cause of death, the difference between them and the other three leading external causes of death are no longer statistically significant.

Death rates due to external causes were consistently higher for men than for women: the disparity ratio (for rates) between males and females decreased only slightly from 2000-2002 to 2012-2014, from 2.5 to 2.3. In the 2000-2002 period death rates due to external causes were significantly higher for Black non-Hispanics than for White non-Hispanics (disparity ratio 1.4), but rates for White non-Hispanics have risen, while those for Black non-Hispanics have fallen: the disparity ratio decreased to 1.0 for the 2012-2014 period. Hispanics have consistently had lower death rates due to external causes than either White non-Hispanics or Black non-Hispanics.
Introduction
External cause of death is a broad category that includes deaths due to environmental events and circumstances, including accidental death, suicide, homicide, death due to legal intervention or war, and death of undetermined intent. External causes are traditionally distinguished from natural causes such as disease (whether infectious or chronic), pregnancy, childbirth and congenital malformations.

The *Kansas Annual Summary of Vital Statistics* presents an annual snapshot of Kansas resident deaths due to external causes, but includes little demographic analysis, and does not investigate multi-year trends.

The goals of this research summary are: a) to determine the principal components of Kansas resident deaths due to external causes, b) to discover any trends in death due to external causes over the 2000-2014 period, and c) to produce basic demographic analyses of external cause of death trends based on sex, population group, and geographic region of residence of decedent.

Methods
All deaths were coded using the International Classification of Diseases, 10th Revision (ICD-10) classification system defined by the World Health Organization [1]. For the purposes of this report, External Causes of Death include codes U01–Y36 and Y85–Y89, which cover accidents, intentional self-harm, assault, events of undetermined intent, legal intervention and operations of war, and various sequelae of these events. Complications of medical and surgical care are excluded.

External causes of death were grouped by mechanism of injury using a modified version of the groupings used to produce the Injury Matrix table for the Annual Summary of Vital Statistics. The modification consists of a division of poisoning deaths between drug poisoning deaths and other poisoning deaths. See Appendix 1 for a listing of the ICD-10 codes included in each of the mechanism of injury categories.

This Report uses partial aggregation of the population group method for reporting race and Hispanic origin as a single construct [2]. Categories of population groups are: Hispanic any race; White non-Hispanic; Black non-Hispanic; American Indian/Alaska Native non-Hispanic; and Asian, Native Hawaiian, and Other Pacific Islander non-Hispanic. Counts for deaths to non-Hispanic Asians and Native Hawaiian and Other Pacific Islander groups were too small to be reported individually.

Age-adjusted death rates were used to make comparisons among population groups, between sexes, among geographic regions, and among individual causes of death, and to maintain comparability over longer time periods that involved significant changes in the population structure of the state. Age-adjusting used the direct method for eleven standard age-groups. Rates were calculated using the bridged-race population estimates prepared by the National Center for Health Statistics (NCHS).
Small number issues raise confidentiality and rate reliability concerns that impact the interpretation of these findings. To address these issues, three years of deaths are combined for statistical reporting. To further address rate reliability this report considers rates with a relative standard of error (RSE) of ≤ 30% as reliable, rates with 30% ≤ RSE ≤ 50% as published with a flag that denotes they are unreliable, and rates with RSE > 50% as suppressed. Unreliable rates will be shaded in tabular data. Dashed lines in charts indicate unreliable rates. Trend lines are suppressed when RSE > 50%. While three-year rates improved rate and trend reliability, some comparisons among population groups were not possible due to extremely low counts.

Since Kansas population groups vary significantly in size, direct rate comparisons between population groups are often not advisable. A population group with a very low number of events may have unreliable rates, or may have confidence intervals that overlap those of several other population groups. A chart that displayed the rates for such populations together with those for populations with large numbers of events, tight confidence intervals, and reliable rates would imply a greater degree of similarity or disparity between the groups than supported by statistical measures.

Upper and lower confidence intervals at 95 percent were prepared for age-adjusted rates. If the confidence intervals for two rates did not overlap, the difference between those rates was statistically significant at the 95-percent level. If they did overlap, the difference was not statistically significant at that level.

The geographic regions used in this report are the six KDHE service areas. For brevity, the names Southeast (SE), Northeast (NE), South Central (SC), North Central (NC), Southwest (SW), and Northwest (NW) Kansas are used.

Findings

General trends in death rates due to external causes
The number of Kansas residents who died due to external causes rose from 4,707 in the 2000-2002 period to 5,866 in the 2012-2014 period. For males, the number of external cause deaths rose from 3,213 to 3,875, and for females, from 1,494 to 1,991.

The corresponding age-adjusted death rates for all Kansas residents rose from 56.9 per 100,000 population in the 2000-2002 period to 65.0 per 100,000 population in the 2012-2014 period, from 82.2 per 100,000 group population to 91.0 per 100,000 group population for males, and from 32.9 per 100,000 group population to 40.3 per 100,000 group population for females (Figure 1). The disparity ratio (for rates) between males and females decreased slightly from 2000-2002 to 2012-2014, from 2.5 to 2.3.
Since external causes of death represent a disparate group, the four leading external causes of death (which accounted for almost 71% of all deaths due to external causes in 2014) were also analyzed separately. For most of the 15 years covered by these analyses, the four leading external causes of death were motor vehicle traffic incidents, firearm incidents, falls, and drug poisonings (drug poisoning replaced suffocation in the top four list in 2002, very early in the period). Motor vehicle traffic incidents were the leading external cause for most of the period, but falls took the top spot in 2013 and 2014 (Table 1).

Table 1. Yearly Ranking of top our leading external causes of death (by count)
Kansas residents, 2000-2014

<table>
<thead>
<tr>
<th>Year</th>
<th>First</th>
<th>Second</th>
<th>Third</th>
<th>Fourth</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>MV* Traffic incident</td>
<td>Firearm incident</td>
<td>Fall</td>
<td>Suffocation</td>
</tr>
<tr>
<td>2001</td>
<td>MV Traffic incident</td>
<td>Firearm incident</td>
<td>Fall</td>
<td>Suffocation</td>
</tr>
<tr>
<td>2002</td>
<td>MV Traffic incident</td>
<td>Firearm incident</td>
<td>Fall</td>
<td>Drug poisoning</td>
</tr>
<tr>
<td>2003</td>
<td>MV Traffic incident</td>
<td>Firearm incident</td>
<td>Fall</td>
<td>Drug poisoning</td>
</tr>
<tr>
<td>2004</td>
<td>MV Traffic incident</td>
<td>Firearm incident</td>
<td>Fall</td>
<td>Drug poisoning</td>
</tr>
<tr>
<td>2005</td>
<td>MV Traffic incident</td>
<td>Firearm incident</td>
<td>Drug poisoning</td>
<td>Fall</td>
</tr>
<tr>
<td>2006</td>
<td>MV Traffic incident</td>
<td>Firearm incident</td>
<td>Drug poisoning</td>
<td>Fall</td>
</tr>
<tr>
<td>2007</td>
<td>MV Traffic incident</td>
<td>Firearm incident</td>
<td>Drug poisoning</td>
<td>Fall (tie)</td>
</tr>
<tr>
<td>2008</td>
<td>MV Traffic incident</td>
<td>Fall</td>
<td>Firearm incident</td>
<td>Drug poisoning</td>
</tr>
<tr>
<td>2009</td>
<td>MV Traffic incident</td>
<td>Fall</td>
<td>Firearm incident</td>
<td>Drug poisoning</td>
</tr>
<tr>
<td>2010</td>
<td>MV Traffic incident</td>
<td>Fall</td>
<td>Firearm incident</td>
<td>Drug poisoning</td>
</tr>
<tr>
<td>2011</td>
<td>MV Traffic incident</td>
<td>Firearm incident</td>
<td>Fall</td>
<td>Drug poisoning</td>
</tr>
<tr>
<td>2012</td>
<td>MV Traffic incident</td>
<td>Firearm incident</td>
<td>Fall</td>
<td>Drug poisoning</td>
</tr>
<tr>
<td>2013</td>
<td>Fall</td>
<td>MV Traffic incident</td>
<td>Drug poisoning</td>
<td>Firearm incident</td>
</tr>
<tr>
<td>2014</td>
<td>Fall</td>
<td>MV Traffic incident</td>
<td>Firearm incident</td>
<td>Drug poisoning</td>
</tr>
</tbody>
</table>

* MV = Motor Vehicle
From the 2000-2002 period to the 2012-2014 period, Kansas resident deaths due to motor vehicle traffic incidents fell from 1,489 to 1,092, while the age-adjusted death rate fell from 18.1 per 100,000 population to 12.4 per 100,000 population. In the same period, deaths due to firearms incidents rose from 848 to 1,030, while the age-adjusted death rate rose from 10.4 per 100,000 population to 11.9 per 100,000 population. Deaths due to poisoning by drugs rose from 404 to 945, while the age-adjusted death rate rose from 5.1 per 100,000 population to 11.3 per 100,000 population. Deaths due to falls rose from 538 to 1,130, while the age-adjusted death rate rose from 6.0 per 100,000 population to 10.9 per 100,000 population.

While most of the age-adjusted death rates for the four leading causes were statistically distinct in the 2000-2002 period (the exception being that the rates for drug poisonings and falls were not statistically distinct from each other), by the 2012-2014 period the age-adjusted death rates for these causes had converged to such a degree that they were no longer statistically distinct (Figure 2).

![Figure 2. Age-adjusted death rates due to four leading external causes of death, Kansas residents, 2000-2014](image)

**Demographic analyses**

Age-adjusted death rates were higher for males than for females in each 3-year period for each of the four leading external causes of death. Both males and females contributed to the decline in motor vehicle traffic accident deaths and to the increases in deaths due to drug poisoning and to falls. The increase in firearms death rates from 10.4 to 11.9 per 100,000 population was driven by increases in male death rates from 18.1 to 20.9 per 100,000 group population, while female firearms death rates were unchanged at 3.1 deaths per 100,000 group population over the 15-year period (Figures 3-6).
Geographic Analysis

Age-adjusted death rates for all external causes were lowest in Northeast Kansas over the entire 2000-2014 period and highest in Southeast Kansas for all but the 2012-2014 period. In 2012-2014, the regions fell into three statistically distinct clusters: Northeast (lowest rate), North Central (middle rate), and South Central, Southeast, Northwest, and Southwest (highest rates) (Figure 7).
Age-adjusted death rates due to motor vehicle traffic accidents were consistently lowest in the Northeast region, but the rates for the other regions were not statistically distinct from one another (Table 2).

<table>
<thead>
<tr>
<th>3-Year Period</th>
<th>Southeast</th>
<th>Northeast</th>
<th>South Central</th>
<th>North Central</th>
<th>Southwest</th>
<th>Northwest</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000-2002</td>
<td>23.4</td>
<td>11.0</td>
<td>16.3</td>
<td>18.5</td>
<td>25.8</td>
<td>23.2</td>
</tr>
<tr>
<td>2003-2005</td>
<td>25.4</td>
<td>12.1</td>
<td>15.5</td>
<td>16.6</td>
<td>28.0</td>
<td>22.2</td>
</tr>
<tr>
<td>2006-2008</td>
<td>26.6</td>
<td>11.6</td>
<td>14.6</td>
<td>14.7</td>
<td>27.3</td>
<td>20.2</td>
</tr>
<tr>
<td>2009-2011</td>
<td>21.4</td>
<td>9.8</td>
<td>14.6</td>
<td>11.7</td>
<td>28.6</td>
<td>25.2</td>
</tr>
<tr>
<td>2012-2014</td>
<td>17.6</td>
<td>8.9</td>
<td>11.5</td>
<td>14.4</td>
<td>24.3</td>
<td>21.9</td>
</tr>
</tbody>
</table>

Age-adjusted death rates due to firearms incidents were not consistently statistically distinct from one region to another (Table 3).

<table>
<thead>
<tr>
<th>3-Year Period</th>
<th>Southeast</th>
<th>Northeast</th>
<th>South Central</th>
<th>North Central</th>
<th>Southwest</th>
<th>Northwest</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000-2002</td>
<td>11.5</td>
<td>10.5</td>
<td>9.4</td>
<td>8</td>
<td>9.3</td>
<td>7.2</td>
</tr>
<tr>
<td>2003-2005</td>
<td>12.8</td>
<td>9.5</td>
<td>10.1</td>
<td>9.4</td>
<td>7.5</td>
<td>13.5</td>
</tr>
<tr>
<td>2006-2008</td>
<td>8.2</td>
<td>10.6</td>
<td>11.5</td>
<td>9.7</td>
<td>7.1</td>
<td>10.9</td>
</tr>
<tr>
<td>2009-2011</td>
<td>13.1</td>
<td>11.1</td>
<td>9.7</td>
<td>11.3</td>
<td>7.9</td>
<td>14.9</td>
</tr>
<tr>
<td>2012-2014</td>
<td>12.3</td>
<td>11.7</td>
<td>12.4</td>
<td>9.3</td>
<td>11.4</td>
<td>15.9</td>
</tr>
</tbody>
</table>

Age-adjusted death rates due to drug poisoning rose in each of the six regions of the state. At the end of the 15-year period, death rates were significantly higher in the South Central and Southeastern regions (cluster 1) than in the remainder of the state (cluster 2) (Table 4).

<table>
<thead>
<tr>
<th>3-Year Period</th>
<th>Southeast</th>
<th>Northeast</th>
<th>South Central</th>
<th>North Central</th>
<th>Southwest</th>
<th>Northwest</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000-2002</td>
<td>5.4</td>
<td>5.4</td>
<td>6.7</td>
<td>3.8</td>
<td>1.0</td>
<td>1.9</td>
</tr>
<tr>
<td>2003-2005</td>
<td>9.0</td>
<td>7.2</td>
<td>12.6</td>
<td>4.6</td>
<td>2.6</td>
<td>3.3</td>
</tr>
<tr>
<td>2006-2008</td>
<td>12.9</td>
<td>8.4</td>
<td>13.5</td>
<td>6.2</td>
<td>3.7</td>
<td>4.9</td>
</tr>
<tr>
<td>2009-2011</td>
<td>12.9</td>
<td>9.8</td>
<td>12.1</td>
<td>10.0</td>
<td>4.7</td>
<td>4.2</td>
</tr>
<tr>
<td>2012-2014</td>
<td>16.7</td>
<td>9.4</td>
<td>15.1</td>
<td>10.3</td>
<td>7.2</td>
<td>8.1</td>
</tr>
</tbody>
</table>

Age-adjusted death rates due to falls for Kansas regions were clustered closely together at the beginning of the 15-year period. Rates for the South Central region rose sharply by the end of the period, while rates for the other regions rose moderately and remained statistically indistinct from one another (Table 5).
Table 6. Age-adjusted death rates due to falls, by 3-year period and by region, Kansas residents, 2000-2014

<table>
<thead>
<tr>
<th>3-Year Period</th>
<th>Southeast</th>
<th>Northeast</th>
<th>South Central</th>
<th>North Central</th>
<th>Southwest</th>
<th>Northwest</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000-2002</td>
<td>5.8</td>
<td>4.9</td>
<td>6.0</td>
<td>7.1</td>
<td>4.3</td>
<td>4.7</td>
</tr>
<tr>
<td>2003-2005</td>
<td>5.6</td>
<td>5.2</td>
<td>8.5</td>
<td>7.9</td>
<td>7.9</td>
<td>5.1</td>
</tr>
<tr>
<td>2006-2008</td>
<td>6.9</td>
<td>7.1</td>
<td>10.7</td>
<td>6.8</td>
<td>6.7</td>
<td>9.1</td>
</tr>
<tr>
<td>2009-2011</td>
<td>6.4</td>
<td>7.9</td>
<td>14.1</td>
<td>10.1</td>
<td>9.6</td>
<td>9.2</td>
</tr>
<tr>
<td>2012-2014</td>
<td>9.7</td>
<td>8.6</td>
<td>16.1</td>
<td>11.8</td>
<td>7.7</td>
<td>8.3</td>
</tr>
</tbody>
</table>

Population group analysis

Age-adjusted death rates due to all external causes were reliable for all population groups. Over the 15 year period, rates for Black non-Hispanics and White non-Hispanics have converged. (Rates for Black non-Hispanics have fallen, while those for White non-Hispanics have risen.) Asian/Pacific Islander non-Hispanics have consistently had the lowest death rates due to external causes, while the other population groups (White non-Hispanics, Black non-Hispanics, American Indian/Alaska Native (AI/AN) non-Hispanics, and Hispanics) have statistically higher rates that are not distinguishable from one another (Figure 8).

Rates for individual external causes of death, on the other hand, are often not reliable for all population groups: comparisons among groups should be made only when all the groups being compared have reliable rates. Instead, comparisons of trends for individual external causes of death will be presented for each population group.

Figure 8. Age-adjusted death rates due to all external causes, by population group, Kansas residents, 2000-2014
Since White non-Hispanics account for slightly over three-quarters (76.8% in 2014) of the state population, rate trends for the leading external causes for that group are very similar to those for the entire population (previously shown in Figure 2). No chart is presented for White non-Hispanics, but counts and rates are available (Appendices 2 and 3).

**Black non-Hispanics**

![Figure 9. Age-adjusted death rates due to four leading external causes, Black non-Hispanic Kansas Residents, 2000-2014](image)

Firearms deaths were the leading external cause of death for Black non-Hispanics throughout the 15-year period, though the rate declined by about 30 percent during that time. Motor vehicle traffic incident deaths declined for this group, but drug poisoning and fall death rates increased (Figure 9).
The American Indian/Alaska Native non-Hispanic population group in Kansas had a small population in comparison to most other population groups during the 2000-2014 period, and event counts and rates for the four leading external causes of death were correspondingly low. For some 3-year periods rates for one or more causes were suppressed due to RSE>50%, leading to gaps in the chart above (Figure 10). Dashed lines indicate that the rates for some 3-year periods had RSE>30% and RSE≤50%, and should be used with caution. Age-adjusted death rates for motor vehicle traffic incidents and drug poisoning fell over the whole period, while rates for firearms incidents rose, but the differences between any two causes were not statistically significant. Full count and rate data are available (Appendices 2 and 3).
Asian and Pacific Islander non-Hispanics

Figure 11. Age-adjusted death rates due to four leading external causes, Asian and Pacific Islander non-Hispanic Kansas Residents, 2000-2014

The Asian and Pacific Islander non-Hispanic population group in Kansas had a small population in comparison to most other population groups during the 2000-2014 period, and event counts and rates for the four leading external causes of death were correspondingly low. For some 3-year periods rates for one or more causes were suppressed due to RSE>50%, leading to gaps in the chart above (Figure 11). Dashed lines indicate that the rates for some 3-year periods had RSE>30% and RSE≤50%, and should be used with caution. Age-adjusted death rates for motor vehicle traffic incidents and firearms incidents fell over the whole period, while event counts for drug poisoning and falls were so low that the rates were suppressed for most years. The differences between any two causes were not statistically significant. Full count and rate data are available (Appendices 2 and 3).
The Hispanic population group in Kansas had a small population in comparison to White non-Hispanics during the 2000-2014 period, although the group population grew rapidly during the period. Event counts and rates for the four leading external causes of death were low at the beginning of the period, and counts for the first two 3-year periods were low enough to trigger some statistical concerns. For one 3-year period the rate for drug poisoning was suppressed due to RSE>50%, leading to a gap in the chart above (Figure 7). Dashed lines indicate that the rates for some 3-year periods had RSE>30% and RSE≤50%, and should be used with caution. Motor vehicle traffic accidents remained the leading external cause of death for Hispanics throughout the period, though it declined over the period. Death rates due to firearm incidents fluctuated throughout the period, but ended very close to where they began. Death rates due to drug poisoning and falls rose during the period. Rates for motor vehicle traffic incidents were statistically higher than those from the other three causes, which were not statistically distinct from one another.
Discussion

The Kansas death rate due to motor vehicle traffic incidents declined by 31.5 percent from the 2000-2002 period to the 2012-2014 period (from 18.1 to 12.4 per 100,000 population). For the same periods, the US death rate due to motor vehicle traffic incidents declined by 30.0 percent (from 15.0 to 10.5 per 100,000 population) [3].

The Kansas death rate due to firearms incidents rose by 14.4 percent from the 2000-2002 period to the 2012-2014 period (from 10.4 to 11.9 per 100,000 population). For the same periods, the US death rate due to firearms incidents rose by 1.0 percent (from 10.3 to 10.4 per 100,000 population) [4].

The Kansas death rate due to drug poisoning more than doubled from 2000 to 2014, rising from 5.2 to 11.3 per 100,000 population. This is consistent with national trends in drug poisoning death rates, which also more than doubled over the 1999-2012 period, from 6.1 to 13.1 per 100,000 population [5].

Kansas death rate due to falls increased by 81.7 percent from the 2000-2002 period to the 2012-2014 period (from 6.0 to 10.9 per 100,000 population). For the same periods, the US death rate due to falls increased by 57.1 percent (from 5.6 to 8.8 per 100,000 population) [6]. Some researchers working with the CDC WONDER online database concluded that sharp increases seen in U.S. fall death rates for the period 1999-2007 were largely the result of improved reporting quality following the transition from ICD-9 to ICD-10 coding of cause of death [7]. However, the continued increases in fall death rates from 2007 to 2014 suggest that the overall increases from 2000 to 2014 involves more than an improvement in reporting quality.
## Appendix 1

### Cause of Death ICD-10 Code Groupings for the Injury Matrix

<table>
<thead>
<tr>
<th>Cause Group</th>
<th>Unintentional</th>
<th>Suicide</th>
<th>Homicide</th>
<th>Undetermined</th>
<th>Legal/War</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cut/Pierce</td>
<td>W25-W29, W45</td>
<td>X78</td>
<td>X99</td>
<td>Y26</td>
<td>Y35.4</td>
</tr>
<tr>
<td>Drowning</td>
<td>W85-W74</td>
<td>X71</td>
<td>X92</td>
<td>Y21</td>
<td>---</td>
</tr>
<tr>
<td>Falls</td>
<td>W00-W19</td>
<td>X80</td>
<td>Y01</td>
<td>Y30</td>
<td>---</td>
</tr>
<tr>
<td>Fire/Flame</td>
<td>X00-X09</td>
<td>X76</td>
<td>X97</td>
<td>Y26</td>
<td>---</td>
</tr>
<tr>
<td>Hot Object/Scalding</td>
<td>X10-X19</td>
<td>X77</td>
<td>X98</td>
<td>Y27</td>
<td>---</td>
</tr>
<tr>
<td>Firearm</td>
<td>W32-W34</td>
<td>X72-X74</td>
<td>U01.4, X93-X95</td>
<td>Y22-Y24</td>
<td>Y35.0</td>
</tr>
<tr>
<td>Machinery</td>
<td>W24, W30-31</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Motor Vehicle Traffic</td>
<td>[V02-V04] (.1,.9), V09.2, [V12-V14] (.3-.9), V19 (.4-.6), [V20-V28] (.3-.9), [V29-V79] (.4-.9), V80 (.3-.5), V81.1, V82.1, [V83-V86] (.0-.3), V87 (.0-.8), V89.2</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Other Pedal Cyclist</td>
<td>V10-V11, [V12-V14] (.0-.2), V15-V18, V19 (.0-.3), V89.2</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Other Pedestrian</td>
<td>V01, [V02-V04] (.0), V05, V06, V09 (.0-.1, .3-.9)</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Other Land Transport</td>
<td>[V20-V28] (.0-.2), [V29-V79] (.0-.3), V80 (.0-.2, .6-.9), [V81-V82] (.0-.2, .9), [V83-V86] (.4-.9), V87.9, V88 (.0-.9), V89 (.0-.1, .3-.9)</td>
<td>X82</td>
<td>Y03</td>
<td>Y32</td>
<td>---</td>
</tr>
<tr>
<td>Other Transport</td>
<td>V90-V99</td>
<td>---</td>
<td>U01.1</td>
<td>---</td>
<td>Y36.1</td>
</tr>
<tr>
<td>Overexertion</td>
<td>X50</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Poisoning</td>
<td>X40-X49</td>
<td>X60-X69</td>
<td>U01 (.6-.7), X85-X90</td>
<td>Y10-Y19</td>
<td>Y35.2</td>
</tr>
<tr>
<td>Drug poisoning</td>
<td>X40-X44</td>
<td>X60-X64</td>
<td>X85</td>
<td>Y10-Y14</td>
<td>---</td>
</tr>
<tr>
<td>Other poisoning</td>
<td>X45-X49</td>
<td>X65-X69</td>
<td>U01 (.6-.7), X86-X90</td>
<td>Y15-Y19</td>
<td>Y35.3</td>
</tr>
<tr>
<td>Struck By/Against</td>
<td>W20-W22, W50-W52</td>
<td>X79</td>
<td>Y00, Y04</td>
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Appendix 2

Number of deaths due to external causes, by mechanism and 3-year period, by population group, Kansas residents, 2000-2014

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<tr>
<th>Cause and Year of Death</th>
<th>Total</th>
<th>White NH</th>
<th>Black NH</th>
<th>NATAM NH</th>
<th>Asian/PI NH</th>
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NATAM = Native American or Alaska Native  
Asian/PI = Asian or Pacific Islander  
NH = Non-Hispanic  

Shaded cells contain counts too low to compute a reliable rate (RSE > 30%).
Appendix 3

Age-adjusted death rates due to external causes, by mechanism and 3-year period, by population group, Kansas residents, 2000-2014

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<th>Cause and Year of Death</th>
<th>Total</th>
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<th>Black NH</th>
<th>NATAM NH</th>
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NATAM = Native American or Alaska Native
Asian/PI = Asian or Pacific Islander
NH = Non-Hispanic

Shaded cells contain unreliable rates (RSE > 30%).
† Rate suppressed (RSE > 50%).

19
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The authors gratefully acknowledge Charles J. Rothwell, Director of the National Center for Health Statistics; Melissa Jim, Epidemiologist, Indian Health Service and Centers for Disease Control and Prevention; and Derek Pate, Epidemiologist, Oklahoma State Department of Health for their support and assistance of this project.

References
Using data in trauma performance improvement: 5 things most teams do wrong

BY ROBERT FOJUT ON MARCH 20, 2017 QUALITY & PI

Performance improvement is a key part of every trauma program. But according to David Kashmer, MD, MBA, many trauma teams fail to make effective use of their most important PI resource — data.

“Using data incorrectly in performance improvement can actually decrease quality,” said Dr. Kashmer, a trauma and acute care surgeon and healthcare quality expert. Poorly handled data, he noted, can mask quality problems and in some cases undermine teamwork.

Dr. Kashmer is a Lean Six Sigma Master Black Belt with extensive experience using data-driven quality strategies. He recently analyzed five mistakes that teams make when using data in trauma PI. He also explained strategies for making data collection easier, collecting more reliable data, interpreting PI data accurately, and monitoring data to make sure performance improvements “stick” over the long haul.

1. Focusing on isolated cases

In most trauma programs, performance improvement focuses on failures within individual cases. “The problem is that reacting to single-case outbreaks actually introduces more variation into a system,” Dr. Kashmer said. “When we make changes based on a single terrible case or one angry email, we are essentially ‘tampering’ with the system. That increases the risk of a Type 1 error — making a change because we think something is wrong when it really isn’t.”
Focusing on failures can also open the PI process to political manipulation. “In healthcare, the squeaky wheel commonly gets the grease,” Dr. Kashmer said. “So when your PI program is built solely on case review, you make it vulnerable to whatever powerful person or group squeaks the loudest or most often. Not only that, you also miss opportunities to repair important issues that no one has squeaked about.”

“All this does not mean single cases are useless,” Dr. Kashmer clarifies, “only that we should be sure to consider cases in the context of our whole system.” To do that, trauma PI teams need to use broad data samples to correctly identify the factors that produce bad outcomes.

“In complex systems such as trauma care, most failures are conspiracies of six or seven underlying factors,” Dr. Kashmer said. “For example, typically it’s not just that the surgeon didn’t decide fast enough to go to the OR. There are likely OR prep issues, ED transfer issues, EMR issues and other factors that create friction within the system. Many factors blend together to give the output we experience as a delay in getting a patient to the operating room. But it’s difficult for us to see the complexity of a whole system and how the probabilities of different parts blend together. If we aren’t careful, we latch onto overly simple answers that focus on just one or two elements.”

The key to avoiding this mistake is to use tools that help identify the full range of factors that could be contributing to poor performance. One of the most effective tools is the Ishikawa diagram, also known as a “fishbone diagram.”

An Ishikawa diagram is a good tool to use for analyzing failures in complex systems, especially when there is disagreement about the root cause of a problem or when there is not a lot of data on what is happening,” Dr. Kashmer said.

To create a basic Ishikawa diagram, draw a horizontal line. Write “Effect” at the right end of the line and note the problem. Next, draw six lines extending outward from the main line. Label these lines with “the five M’s and one P”: Materials, Machine, Method, Mother Nature, Management and People. Working as a team, fill in the chart with all the factors that could be contributing to the identified problem. For example, if a team was brainstorming possible causes for delayed operative care in a patient with a small bowel injury, their Ishikawa diagram might list some of the following potential factors:

- **Materials:**
  - The patient was morbidly obese and unable to fit into the CT scanner. (“Since CTs may help find bowel injuries earlier, failure to perform CT may delay recognition of these injuries,” Dr. Kashmer noted.)
  - Morbid obesity may have limited the ability of the abdominal exam to demonstrate small bowel injury.
  - *(Note: In healthcare, “materials” are commonly the patient factors, because patients are what the system works on. “So morbid obesity may be listed as an important patient factor — it doesn’t make it impossible to find a small bowel injury promptly, but it may make it more difficult.”)*

- **Machine:**
Lab tests, including amylase and lactate, were not drawn in a timely fashion owing to EMR issues.
The CT was busy with another patient (not actually an issue for the case under consideration, but included by the team for the sake of identifying all the potential factors that could lead to OR delays).

- **Method:**
  - It requires five calls to contact the OR team.
  - It takes the team 30 minutes to drive in from home.

- **Mother nature:**
  - Poor weather hampered team response.
  - The trauma team got busy with other activations, delaying reexamination of the patient.

- **Management/Measurement:**
  - OR management requires the trauma surgeon to make several calls and justify use of an operating room.

- **People:**
  - Someone failed to answer the phone.
  - The surgical team missed an obvious sign that the patient required the OR.

“This scenario highlights how many different factors, some controllable and some not controllable, line up to make it more likely that this patient with this injury will take longer to get to the OR,” Dr. Kashmer said.

Once you have filled out your fishbone, label the different factors as either “controllable” or “noise” that cannot be controlled. “Collect data on the factors involved, and then perform multiple regression analysis to identify which controllable and non-controllable factors are truly correlated with the effect,” he said. “Sometimes you discover interesting things — for instance, that factors you cannot directly control are ones that correlate with the outcome. More importantly, sometimes you learn that factors you can control impact the probability of a defect. Focus on those.”

“Remember, each category likely has multiple factors, and the factors you identify with the Ishikawa tool are still just opinion,” he said. “You still must collect data and analyze it properly if you want to go by more than just your opinion. But this process helps ensure your team looks at all the potential causes of a PI problem, not just the ‘people’ issues that so often attract the most attention.”

**2. Relying on hospital databases**

Many trauma PI initiatives use clinical and administrative databases maintained by the hospital. “The problem is that hospital databases sometimes don’t represent the process as well as data collected directly from the system,” Dr. Kashmer said. “These databases tend to filter out information about problems.”

Dr. Kashmer believes it often makes sense to use trauma registry data in PI. However, he cautions trauma leaders about the reliability of this data. A recent study suggests the accuracy rate of trauma registry data is quite low.

“Remember, data that makes it into registries and warehouses in all fields is often cleaned up somehow,” he said. “Many times, staff record numbers as estimates or when they remember to do so. It’s typically not intentional, but in acute trauma situations what makes it on the paper may not be perfect. More importantly, your particular issue may need a piece of data that isn’t commonly
recorded. Or you may need data that has a different operational definition than the same data field in the registry.”

“I know most of us use registry data for trauma PI,” Dr. Kashmer said. “It’s what we have and it’s much better than what we commonly see in other services. However, for addressing a PI issue I highly suggest collecting some data right from the process. It’s amazing how different things look when you have prospective data that didn’t come from a data warehouse or a registry.”

Prospective data collection allows teams to focus on very specific and useful endpoints. “If we want to find out how long it takes to get fresh frozen plasma to the bedside, we want to have a member of the trauma team marking times for 100 consecutive doses,” Dr. Kashmer said. “Collecting data right from the process lets you make sure you are measuring useful endpoints in a way that is statistically rigorous.”

One other advantage of using prospective data is it allows you to structure data collection to ensure anonymity. This helps prevent the finger-pointing that is so detrimental to performance improvement.

“Some people are worried that data will uncover some problem with them personally,” Dr. Kashmer said. “When I work with a trauma team, we don’t include names in the data collection and the data are not traceable to individual providers.”

3. Making data collection painful

Some trauma PI teams fail by trying to collect too much data. “You don’t need a million data points,” Dr. Kashmer said. “Usually four or five well-chosen endpoints are all you need to adequately characterize performance.”

Dr. Kashmer recommends a systematic approach to planning data collection. First, create a SIPOC (Suppliers-Input-Process-Output-Customers) diagram of the PI project. Start in the middle with process, and define the five or six high-level steps that characterize the process you are working on. In healthcare the input is generally the patient, and the output is the patient having received some defined intervention.

Second, decide on the endpoints you need to track. “In medicine, we often want to get data on 40 different endpoints,” Dr. Kashmer said. “That’s really not necessary. Usually you only need about five endpoints to completely characterize a system.” Using your SIPOC diagram, select one or two measures from each of the input, process and output phases.

For example, say you are often unable to get an EMS report for severely injured patients admitted to your trauma center. You want to get data on this issue to (a) determine if there really is a problem and (b) understand how to fix it. Data collection in this scenario might be as simple as tracking a handful of endpoints:
**Input measures:** To track inputs, you create a measure of *EMS report completeness*. For example, you decide on five key elements you require in an EMS report and score each report on a scale of 1 to 5.

**Process measures:** You decide to create a measure called *time until EMS report*. The clock starts when EMS arrives on scene and stops when someone at the trauma center is notified about the patient, either prehospital via phone/radio or by report when the patient arrives in the trauma bay. (The project’s goal may be to minimize the time from arrival on scene to trauma team notification.)

**Output measures:** Some of the value of the prehospital EMS report is that it allows preparation for patient arrival, appropriate level of trauma activation, and advance warning for part of the trauma team so it can arrive on time. Therefore, you may choose to measure *undertriage rate*, *provider arrival time*, or a tailored endpoint you create that has value at your center.

“Part of the art of selecting endpoints is deciding early on whether you will collect continuous or discrete data,” Dr. Kashmer said. “From the point of view of simplicity, each approach has advantages and disadvantages.”

Discrete data are “categorical” — for example, *yes/no*, *ground/helicopter* or *live/die*. Continuous data are data that can be divided into smaller and smaller units and still be meaningful — for instance, *time* or *length*.

“The main advantage of discrete data is that it can be collected very easily and rapidly,” Dr. Kashmer said. “The downside is that discrete data will often require a large sample size to ensure statistical validity.” In contrast, the main advantage of continuous data is that it generally requires a smaller sample size to demonstrate something meaningful.

Whichever endpoints you choose, calculate sample size ahead of time. (For an explanation of how to calculate sample size for both continuous and discrete data, read *How You Measure the Surgical Checklist Determines What You Find*.)

“While it is true that many PI projects do not collect enough data, others seem to get stuck in data collection mode indefinitely,” Dr. Kashmer said. “Establishing a statistically valid sample size will help you make sure your team avoids unnecessary work.”

### 4. Fumbling the analysis

Correct analysis makes the difference between useful data and muddled information. According to Dr. Kashmer, trauma program staff often need training in data analysis techniques. At a minimum, it is important to understand methods for analyzing and interpreting continuous and discrete data and performing multiple and logistic regressions.

“One key skill is understanding how to interpret histograms,” Dr. Kashmer said. “You need to be able to say to the team, ‘This is how our data distribution curve looks, here is our upper specification limit and here are our defects.’”

For example, a state may require surgeons to be present in the trauma bay within 10 minutes of patient arrival. “In this case, the upper specification limit is defined by the regulatory authority,” Dr.
Kashmer said, “Any data points above that limit are your defects. From that, you can calculate your defect rate.”

Data distribution curves can help trauma teams visualize their performance and better understand their PI opportunities. However, one common pitfall is misinterpreting the concept of defects and defect rates.

“Most service industries work at the rate of one defect in every 1,000 opportunities, and that is also what we usually see when we begin working on a healthcare process,” Dr. Kashmer said. “Everyone feels good because 999 times out of a thousand, things are going great. But in trauma, that one defect can be a real problem. That same level of performance, for example, would mean that one plane would crash each day at a busy airport like O’Hare. So that typical level of performance doesn’t work in healthcare.”

According to Dr. Kashmer, trauma teams should aim for a much lower defect rate. For example, a rate of 0.0004% — or one defect for every 250,000 opportunities — is achievable. “In my experience, that can be achieved by an excellent PI process. It’s tough to get there, but it is doable. In healthcare, we all aim for zero defects, of course, and some quality improvement systems do achieve incredibly low rates like one defect per every million opportunities.”

5. Monitoring the wrong control data

“The control phase of a PI project lets you know when to intervene — when to trim the weeds again,” Dr. Kashmer said. However, most trauma teams use the wrong control charts.

“Many people decide to use an I-MR chart — or ‘individuals and moving range’ chart — to monitor their performance,” Dr. Kashmer said. When used correctly, an I-MR chart can detect variations in performance that indicate a process is out of control.

“An I-MR can let you know when a process is broken, often before a true error occurs,” he said. “The problem, which most people don’t realize, is that I-MR charts are only effective if your data are normally distributed.”

The mathematics describing normal versus non-normal data distribution can be complex. For the sake of simplicity, one can say that normally distributed data will produce a bell-shaped curve.

“If your data do not describe the normal curve that we all love, many of us feel an I-MR chart won’t be able to tell you much,” Dr. Kashmer said. “You will first need to perform a data transformation, such as the Box-Cox transformation, which can force data into a normal distribution by raising it to a power.”
Another common pitfall is monitoring control data before a process has been optimized. “The only thing a control chart can tell you is whether your system is performing as expected,” Dr. Kashmer said.

“Say that your state gives you two hours to get patients to the OR,” he said. “If your normal data distribution centers at two hours, your control chart will tell you that everything is within the control limits and, essentially, that everything is fine. Unless you get an event that is more than three standard deviations away, the control chart will not raise any alarms.”

“I remember a trauma center that thought it was doing just fine because its control chart for time until surgeon arrival in the trauma bay looked great,” Dr. Kashmer said. “No points were out of control. But guess what: The system was just performing at its routine level of variation.”

“Even though the control chart looked fine, surgeons were frequently unable to arrive in the ED until well beyond 15 minutes,” he said. “The routine level of variation was totally unacceptable, and the trauma center had been misled by the control chart.”

**Stronger teams**

A rigorous approach to data is challenging, but the results can be energizing. “When a trauma team begins to look at data in a rigorous way that is non-pejorative and keeps them focused on the system instead of picking on individuals, things improve,” Dr. Kashmer said.

“At first, teams often find they’re not in a good place,” he said. “But when a team gets an accurate look at its performance through good data, people start asking what changes they can make to improve their performance as a team and a system. Next thing you know, that data- and team-driven approach allows for constant improvement and success.”

**About the Expert**

David Kashmer, MD, MBA, is a trauma and acute care surgeon and healthcare quality expert. He is a Lean Six Sigma Master Black Belt and was recently named to the Malcolm Baldrige Board of Examiners.
Dr. Kashmer writes frequently about data-driven healthcare quality improvement at TheSurgicalLab.com and TheHealthcareQualityBlog.com. His writing has also been published by TheHill.com, Insights.TheSurgicalLab.com and OR Manager. He is the author of the recent Amazon bestseller, *Volume To Value: Proven Methods for Achieving High Quality in Healthcare*. 